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SOME COMMON BIRDS

IN THEIR RELATION TO AGRICULTURE.

BY

F. E. L. BEAL, B. S.,
ASSISTANT ORNITHOLOGIST, BIOLOGICAL SURVEY.

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SOME COMMON BIRDS IN THEIR RELATION TO AGRICULTURE.

INTRODUCTION.

It has long been known that birds play an important part in relation to agriculture, but there seems to be a tendency to dwell on the harm they do rather than on the good. Whether a bird is injurious or beneficial depends almost entirely upon what it eats, and in the case of species which are unusually abundant or which depend in part upon the farmer's crops for subsistence the character of the food often becomes a very practical question. If crows or blackbirds are seen in numbers about cornfields, or if woodpeckers are noticed at work in an orchard, it is perhaps not surprising that they are accused of doing harm. Careful investigation, however, often shows that they are actually destroying noxious insects, and also that even those which do harm at one season may compensate for it by eating noxious species at another. Insects are eaten at all times by the majority of land birds, and during the breeding season most kinds subsist largely and rear their young exclusively on this food. When insects are unusually plentiful, they are eaten by many birds which ordinarily do not touch them. Even birds of prey resort to this diet, and when insects are more easily obtained than other fare, the smaller hawks and owls live on them almost entirely. This was well illustrated during the recent plague of Rocky Mountain locusts in the Western States, when it was found that locusts were eaten by nearly every bird in the region, and that they formed almost the entire food of a large majority of the species.

Within certain limits, birds feed upon the kind of food that is most accessible. Thus, as a rule, insectivorous birds eat the insects that are most easily obtained, provided they do not have some peculiarly disagreeable property. It is not probable that a bird habitually passes by one kind of insect to look for another which is more appetizing, and there seems little evidence in support of the theory that the selection of food is restricted to any particular species of insect, for it is evident that a bird eats those which by its own method of seeking are most easily obtained. Thus, a ground-feeding bird eats those it finds among the dead leaves and grass; a flycatcher, watching for its prey from some vantage point, captures entirely different kinds; and the

woodpecker and warbler, in the tree tops, select still others. It is thus apparent that a bird's diet is likely to be quite varied, and to differ at different seasons of the year.

In investigating the food habits of birds, field observation can be relied on only to a limited extent, for it is not always easy to determine what a bird really eats by watching it. In order to be positive on this point, it is necessary to examine the stomach contents. When birds are suspected of doing injury to field crops or fruit trees, a few individuals should be shot and their stomachs examined. This will show unmistakably whether or not the birds are guilty.

In response to a general demand for definite information regarding the food habits of our native birds, the Biological Survey of the Department of Agriculture has for some years past been conducting a systematic investigation of the food of species which are believed to be of economic importance. Thousands of birds' stomachs have been carefully examined in the laboratory, and all the available data respecting the food brought together. The results of the investigations relating to birds of prey, based on an examination of nearly 3,000 stomachs, were published in 1893, in a special bulletin entitled The Hawks and Owls of the United States. Many other species have been similarly studied and the results published, either in special bulletins or as articles in the yearbooks. The present bulletin contains brief abstracts of the results of food studies of about 30 grain and insect eating birds belonging to 10 different families.[1]

These species comprise among others the crow blackbirds and ricebirds, against which serious complaints have been made on account of the damage they do to corn, wheat, rice, and other crops; and also the cuckoos, grosbeaks, and thrashers, which are generally admitted to be beneficial, but whose true value as insect destroyers has not been fully appreciated. The practical value of birds in controlling insect pests should be more generally recognized. It may be an easy matter to exterminate the birds in an orchard or grain field, but it is an extremely difficult one to control the insect pests. It is certain, too, that the value of our native sparrows as weed destroyers is not appreciated. Weed seed forms an important item of the winter food of many of these birds, and it is impossible to estimate the immense numbers of noxious weeds which are thus annually destroyed.

[1] The limits of this bulletin preclude giving more than a very brief statement regarding the food of each bird, but more detailed accounts of some of the species will be found in the following reports of the Biological Survey (formerly Division of Ornithology and Mammalogy): The Cuckoos—Bulletin No. 9, 1898, pp. 1–14; Crow—Bulletin No. 6, 1895, pp. 1–98; Woodpeckers—Bulletin No. 7, 1895, pp. 1–39; Kingbird—Annual Report Secretary of Agriculture for 1893, pp. 233–234; Redwinged Blackbird—Yearbook for 1897, pp. 349–351; Baltimore Oriole—Yearbook for 1895, pp. 426–430; Grackles—Yearbook for 1894, pp. 233–248; Meadowlark—Yearbook for 1895, pp. 420–426; Cedarbird—Annual Report Secretary of Agriculture for 1892, pp. 197–200; Catbird, Brown Thrasher, and Wren—Yearbook for 1895, pp. 405–418.

If birds are protected and encouraged to nest about the farm and garden, they will do their share in destroying noxious insects and weeds, and a few hours spent in putting up boxes for bluebirds, martins, and wrens will prove a good investment. Birds are protected by law in many States, but it remains for the agriculturists to see that the laws are faithfully observed.

THE CUCKOOS.

(*Coccyzus americanus* and *C. erythrophthalmus*.)

Two species of cuckoos, the yellow-billed (fig. 1) and the black-billed, are common in the United States east of the Plains, and a subspecies of the yellow-billed extends westward to the Pacific. While the two species are quite distinct, they do not differ greatly in food habits, and their economic status is practically the same.

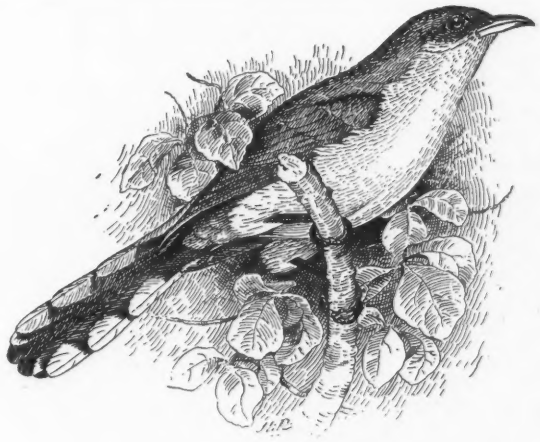

FIG. 1.—Yellow-billed cuckoo.

An examination of 155 stomachs has shown that these cuckoos are much given to eating caterpillars, and, unlike most birds, do not reject those covered with hair. In fact, cuckoos eat so many hairy caterpillars that the hairs pierce the inner lining of the stomach and remain there, so that when the stomach is opened and turned inside out, it appears to be lined with a thin coating of fur.

An examination of the stomachs of 46 black-billed cuckoos, taken during the summer months, showed the remains of 906 caterpillars, 44 beetles, 96 grasshoppers, 100 sawflies, 30 stink bugs, and 15 spiders. In all probability more individuals than these were represented, but their remains were too badly broken for recognition. Most of the caterpillars were hairy, and many of them belonged to a genus that lives in colonies and feeds on the leaves of trees, including the apple tree. One stomach was filled with larvæ of a caterpillar belonging to the

same genus as the tent caterpillar, while others contained that species. Other larvæ were those of large moths, for which the bird seems to have a special fondness. The beetles were mainly click beetles and weevils, with a few May beetles. The sawflies were all found in two stomachs, one of which contained no less than 100 in the larval stage.

Of the yellow-billed cuckoo, 109 stomachs (collected from May to October, inclusive) were examined. The contents consisted of 1,865 caterpillars, 93 beetles, 242 grasshoppers, 37 sawflies, 69 bugs, 6 flies, and 86 spiders. Most of the caterpillars belonged to hairy species and many of them were of large size. One stomach contained 250 American tent caterpillars; another 217 fall webworms. In places where tent caterpillars are abundant they seem to constitute a large portion of the food of these two birds. The beetles were distributed among several families, but all more or less harmful to agriculture. In the same stomach which contained the tent caterpillars were two Colorado potato beetles; in another were three goldsmith beetles and remains of several other large beetles. Besides grasshoppers were several katydids and tree crickets. The sawflies were in the larval stage, in which they resemble caterpillars so closely that they are commonly called false caterpillars, and perhaps this likeness may be the reason the cuckoos eat them so freely. The bugs consisted of stink bugs and cicadas or dog-day harvest flies, with the single exception of one wheel bug, which was the only useful insect eaten, unless the spiders be counted as such.

THE WOODPECKERS.

Five or six species of woodpeckers are familiarly known throughout the eastern United States, and in the west are replaced by others of similar habits. Several species remain in the northern States through the entire year, while others are more or less migratory.

Farmers are prone to look upon wookpeckers with suspicion. When the birds are seen scrambling over fruit trees and pecking at the bark, and fresh holes are found in the tree, it is concluded that they are doing harm. Careful observers, however, have noticed that, excepting a single species, these birds rarely leave any important mark on a healthy tree, but that when a tree is affected by wood-boring larvæ the insects are accurately located, dislodged, and devoured. In case the holes from which the borers are taken are afterwards occupied by colonies of ants, these ants in turn are drawn out and eaten.

Two of the best known woodpeckers, the hairy woodpecker (*Dryobates villosus*) (fig. 2) and the downy woodpecker (*D. pubescens*), including their races, range over the greater part of the United States, and for the most part remain throughout the year in their usual haunts. They differ chiefly in size, for their colors are practically the same, and the males, like other woodpeckers, are distinguished by a scarlet patch on the head.

An examination of many stomachs of these two birds shows that from two-thirds to three-fourths of the food consists of insects, chiefly noxious. Wood-boring beetles, both adults and larvæ, are conspicuous, and with them are associated many caterpillars, mostly species that burrow into trees. Next in importance are the ants that live in decaying wood, all of which are sought by woodpeckers and eaten in great quantities. Many ants are particularly harmful to timber, for if they find a small spot of decay in the vacant burrow of some wood-borer, they enlarge the hole, and as their colony is always on the increase, continue to eat away the wood until the whole trunk is honey-

FIG. 2.—Hairy woodpecker.

combed. Moreover, these insects are not accessible to other birds, and could pursue their career of destruction unmolested were it not that the woodpeckers, with beaks and tongues especially fitted for such work, dig out and devour them. It is thus evident that woodpeckers are great conservators of forests. To them, more than to any other agency, we owe the preservation of timber from hordes of destructive insects.

One of the larger woodpeckers familiar to everyone is the flicker, or golden-winged woodpecker (*Colaptes auratus*) (fig. 3), which is generally distributed throughout the United States from the Atlantic Coast to

the Rocky Mountains. It is there replaced by the red-shafted flicker (*C. cafer*), which extends westward to the Pacific. The two species are as nearly identical in food habits as their environment will allow. The flickers, while genuine woodpeckers, differ somewhat in habits from the rest of the family, and are frequently seen upon the ground searching for food. Like the downy and hairy woodpeckers, they eat wood-boring grubs and ants, but the number of ants eaten is much greater. Two of the flickers' stomachs examined were completely filled with ants, each stomach containing more than 3,000 individuals. These ants belonged to species which live in the ground, and it is these insects for which the flicker is searching when running about in the grass, although some grasshoppers are also taken.

FIG. 3.—Flicker.

The red-headed woodpecker (*Melanerpes erythrocephalus*) (fig. 4) is well known east of the Rocky Mountains, but is rather rare in New England. Unlike some of the other species, it prefers fence posts and telegraph poles to trees as a foraging ground. Its food therefore naturally differs from that of the preceding species, and consists largely of adult beetles and wasps, which it frequently captures on the wing, after the fashion of flycatchers. Grasshoppers also form an important part of the food. The redhead has a peculiar habit of selecting very large beetles, as shown by the presence of fragments of several of the largest species in the stomachs. Among the beetles were quite a number of predaceous ground beetles, and unfortunately some tiger beetles, which are useful insects. The redhead has been accused of robbing the nests

of other birds; also of attacking young birds and poultry and pecking out their brains, but as the stomachs showed little evidence to substantiate this charge it is probable that the habit is rather exceptional.

It has been customary to speak of the smaller woodpeckers as "sapsuckers," under the belief that they drill holes in the bark of trees for the purpose of drinking the sap and eating the inner bark. Close observation, however, has fixed this habit upon only one species, the yellow-bellied woodpecker, or sapsucker (*Sphyrapicus varius*) (fig 5). This bird has been shown to be guilty of pecking holes in the bark of various forest trees, and sometimes in that of apple trees, from which it drinks the sap

FIG. 4.—Red-headed woodpecker.

when the pits become filled. It has been proved, however, that besides taking the sap the bird captures large numbers of insects which are attracted by the sweet fluid, and that these form a very considerable portion of its diet. In some cases the trees are injured by being thus punctured, and die in a year or two, but since comparatively few are touched the damage is not great. It is equally probable, moreover, that the bird fully compensates for this injury by the insects it consumes.

The vegetable food of woodpeckers is varied, but consists largely of small fruits and berries. The downy and hairy woodpeckers eat such fruits as dogwood, Virginia creeper, and others, with the seeds of

poison ivy, sumac, and a few other shrubs. The flicker also eats a great many small fruits and the seeds of a considerable number of shrubs and weeds. None of the three species is much given to eating cultivated fruits or crops.

The redhead has been accused of eating the larger kinds of fruit, such as apples, and also of taking considerable corn. The stomach examinations show that to some extent these charges are substantiated, but that the habit is not prevalent enough to cause much damage. It is quite fond of mast, especially beechnuts, and when these nuts are

FIG. 5.—Yellow-bellied woodpecker.

plentiful the birds remain north all winter, instead of migrating as is their usual custom.

Half the food of the sapsucker, aside from sap, consists of vegetable matter, largely berries of the kinds already mentioned, and also a quantity of the inner bark of trees, more of which is eaten by this species than by any other.

Many other woodpeckers are found in America, but their food habits agree in the main with those just described. These birds are certainly

the only agents which can successfully cope with certain insect enemies of the forests, and, to some extent, of fruit tree salso. For this reason, if for no other, they should be protected in every possible way.

THE KINGBIRD.

(*Tyrannus tyrannus.*)

The kingbird (fig. 6) is essentially a lover of the orchard, and wherever the native groves have been replaced by fruit trees this pugnacious bird takes up its abode. It breeds in all of the States east of the Rocky Mountains, and less commonly in the Great Basin and on the Pacific Coast. It migrates south early in the fall, and generally leaves the United States to spend the winter in more southern latitudes.

FIG. 6.—Kingbird.

The kingbird manifests its presence in many ways. It is somewhat boisterous and obtrusive, and its antipathy for hawks and crows is well known. It never hesitates to give battle to any of these marauders, no matter how superior in size, and for this reason a family of kingbirds is a desirable adjunct to a poultry yard. On one occasion in the knowledge of the writer a hawk which attacked a brood of young turkeys was pounced upon and so severely buffeted by a pair of kingbirds, whose nest was near by, that the would-be robber was glad to escape without his prey. Song birds that nest near the kingbird are similarly protected.

In its food habits this species is largely insectivorous. It is a true flycatcher by nature, and takes a large part of its food on the wing. It

does not, however, confine itself to this method of hunting, but picks up some insects from trees and weeds, and even descends to the ground in search of myriapods or thousand legs. The chief complaint against the kingbird is that it preys largely upon honeybees; and this charge has been made both by professional bee keepers and others. Many observers have seen the bird at work near hives, and there is no reason to doubt the honesty of their testimony. One bee raiser in Iowa, suspecting the kingbirds of feeding upon his bees, shot a number near his hives, but when the birds' stomachs were examined by an expert entomologist not a trace of honeybees could be found.

The Biological Survey has made an examination of 281 stomachs collected in various parts of the country, but found only 14 containing remains of honeybees. In these 14 stomachs there were in all 50 honeybees, of which 40 were drones, 4 were certainly workers, and the remaining 6 were too badly broken to be identified as to sex.

The insects that constitute the great bulk of the food of this bird are noxious species, largely beetles—May beetles, click beetles (the larvæ of which are known as wire worms), weevils, which prey upon fruit and grain, and a host of others. Wasps, wild bees, and ants are conspicuous elements of the food, far outnumbering the hive bees. During summer many grasshoppers and crickets, as well as leaf hoppers and other bugs, are also eaten. Among the flies were a number of robber flies—insects which prey largely upon other insects, especially honeybees, and which have been known to commit in this way extensive depredations. It is thus evident that the kingbird by destroying these flies actually does good work for the apiarist. Nineteen robber flies were found in the stomachs examined; these may be considered more than an equivalent for the four worker honeybees already mentioned. A few caterpillars are eaten, mostly belonging to the group commonly known as cutworms, all the species of which are harmful. About 10 per cent of the food consists of small native fruits, comprising some twenty common species of the roadsides and thickets, such as dogwood berries, elder berries, and wild grapes. The bird has not been reported as eating cultivated fruit to an injurious extent, and it is very doubtful if this is ever the case, for cherries and blackberries are the only ones that might have come from cultivated places, and they were found in but few stomachs.

Three points seem to be clearly established in regard to the food of the kingbird—(1) that about 90 per cent consists of insects, mostly injurious species; (2) that the alleged habit of preying upon honeybees is much less prevalent than has been supposed, and probably does not result in any great damage; and (3) that the vegetable food consists almost entirely of wild fruits which have no economic value. These facts, taken in connection with its well-known enmity for hawks and crows, entitle the kingbird to a place among the most desirable birds of the orchard or garden.

THE PHŒBE.

(*Sayornis phœbe.*)

Among the early spring arrivals at the North, none are more welcome than the phœbe (fig. 7). Though naturally building its nest under an overhanging cliff of rock or earth, or in the mouth of a cave, its preference for the vicinity of farm buildings is so marked that in the more thickly settled parts of the country the bird is seldom seen at any great distance from a farmhouse except where a bridge spans some stream, affording a secure spot for a nest. Its confiding disposition has rendered it a great favorite, and consequently it is seldom disturbed. It breeds throughout the United States east of the Great Plains, and winters from the South Atlantic and Gulf States southward.

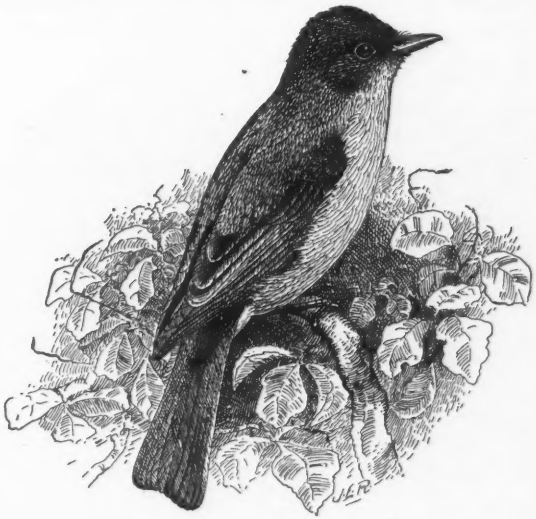

FIG. 7.—Phœbe.

The phœbe subsists almost exclusively upon insects, most of which are caught upon the wing. An examination of 80 stomachs showed that over 93 per cent of the year's food consists of insects and spiders, while wild fruit constitutes the remainder. The insects belong chiefly to noxious species, and include many click beetles, May beetles, and weevils. Grasshoppers in their season are eaten to a considerable extent, while wasps of various species, many flies of species that annoy cattle, and a few bugs and spiders are also eaten regularly. It is evident that a pair of phœbes must materially reduce the number of insects near a garden or field, as the birds often, if not always, raise two broods a year, and each brood numbers from four to six young.

The vegetable portion of the food is unimportant, and consists mainly of a few seeds, with small fruits, such as wild cherries, elder berries, and

juniper berries. The raspberries and blackberries found in the stomachs were the only fruits that might have belonged to cultivated varieties, and the quantity was trifling.

There is hardly a more useful species than the phœbe about the farm, and it should receive every encouragement. To furnish nesting boxes is unnecessary, as it usually prefers a more open situation, like a shed, or a nook under the eaves, but it should be protected from cats and other marauders.

THE BLUE JAY.

(*Cyanocitta cristata.*)

The blue jay (fig. 8) is a common bird of the United States east of the Great Plains, and remains throughout the year in most of its range, although its numbers are somewhat reduced in winter in the Northern States. During spring and summer the jay is forced to become an

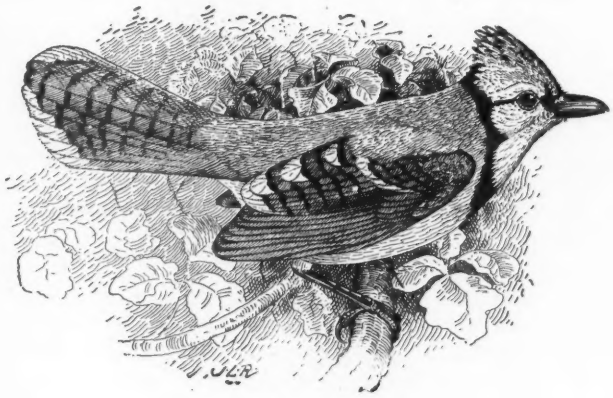

FIG. 8.—Blue jay.

industrious hunter for insects, and is not so conspicuous a feature of the landscape as when it roams the country at will after the cares of the nesting season are over.

Ornithologists and field observers in general declare that a considerable portion of its food in spring and early summer consists of the eggs and young of small birds, and some farmers accuse it of stealing corn to an injurious extent in the fall. While there may be some truth in these accusations, they have almost certainly been exaggerated. No doubt many jays have been observed robbing nests of other birds, but thousands have been seen that were not so engaged.

In an investigation of the food of the blue jay 292 stomachs were examined, which showed that animal matter comprised 24 per cent and vegetable matter 76 per cent of the bird's diet. So much has been said about the nest-robbing habits of the jay that special search was made for traces of birds or birds' eggs in the stomachs, with the result that shells

of small birds' eggs were found in three and the remains of young birds in only two stomachs. Such negative evidence is not sufficient to controvert the great mass of testimony upon this point, but it shows that the habit is not so prevalent as has been believed. Besides birds and their eggs, the jay eats mice, fish, salamanders, snails, and crustaceans, which altogether constitute but little more than 1 per cent of its diet. The insect food is made up of beetles, grasshoppers, caterpillars, and a few species of other orders, all noxious, except some 3½ per cent of predaceous beetles. Thus something more than 19 per cent of the whole food consists of harmful insects. In August the jay, like many other birds, turns its attention to grasshoppers, which constitute nearly one-fifth of its food during that month. At this time, also, most of the other noxious insects, including caterpillars, are consumed, though beetles are eaten chiefly in spring.

The vegetable food is quite varied, but the item of most interest is grain. Corn was found in 70 stomachs, wheat in 8, and oats in 2—all constituting 19 per cent of the total food. Corn is evidently the favorite grain, but a closer inspection of the record shows that the greater part was eaten during the first five months of the year, and that very little was taken after May, even in harvest time, when it is abundant. This indicates that most of the corn is gleaned from the fields after harvest, except what is stolen from cribs or gathered in May at planting time.

The jay's favorite food is mast (i. e., acorns, chestnuts, chinquapins, etc.), which was found in 158 of the 292 stomachs and amounted to more than 42 per cent of the whole food. In September corn formed 15 and mast 35 per cent, while in October, November, and December corn dropped to an almost inappreciable quantity and mast amounted to 64, 82, and 83 per cent, respectively. And yet in these months corn is abundant and everywhere easily accessible. The other elements of food consist of a few seeds and wild fruits, among which grapes and blackberries predominate.

The results of the stomach examination show, (1) that the jay eats many noxious insects; (2) that its habit of robbing the nests of other birds is much less common than has been asserted; and (3) that it does little harm to agriculture, since all but a small amount of the corn eaten is waste grain.

THE CROW.

(*Corvus americanus.*)

There are few birds so well known as the common crow, and unlike most other species he does not seem to decrease in numbers as the country becomes more densely populated. The crow is commonly regarded as a blackleg and a thief. Without the dash and brilliancy of the jay, or the bold savagery of the hawk, he is accused of doing more mischief than either. That he does pull up sprouting corn, destroy chickens, and rob the nests of small birds has been repeatedly

proved. Nor are these all of his sins. He is known to eat frogs, toads, salamanders, and some small snakes, all harmless creatures that do some good by eating insects. With so many charges against him, it may be well to show why he should not be utterly condemned.

The examination of a large number of stomachs, while confirming all the foregoing accusations, has thrown upon the subject a light somewhat different from that derived solely from field observation. It shows that the bird's-nesting habit, as in the case of the jay, is not so universal as has been supposed; and that, so far from being a habitual nest robber, the crow only occasionally indulges in that reprehensible practice. The same is true in regard to destroying chickens, for he is able to carry off none but very young ones, and his opportunities for capturing them are somewhat limited. Neither are many toads and frogs eaten, and as frogs are of no great practical value, their destruction is not a serious matter; but toads are very useful, and their consumption, so far as it goes, must be counted against the crow. Turtles, crayfishes, and snails, of which he eats quite a large number, may be considered neutral, while mice may be counted to his credit.

In his insect food, however, the crow makes amends for sins in the rest of his dietary, although even here the first item is against him. Predaceous beetles are eaten in some numbers throughout the season, but the number is not great. May beetles, "dor-bugs," or June bugs, and others of the same family, constitute the principal food during spring and early summer, and are fed to the young in immense quantities. Other beetles, nearly all of a noxious character, are eaten to a considerable extent. Grasshoppers are first taken in May, but not in large numbers until August, when, as might be expected, they form the leading article of diet, showing that the crow is no exception to the general rule that most birds subsist, to a large extent, upon grasshoppers in the month of August. Many bugs, some caterpillars, mostly cutworms, and some spiders are also eaten—all of them either harmful or neutral in their economic relations. Of the insect diet Mr. E. A. Schwarz says: "The facts, on the whole, speak overwhelmingly in favor of the crow."

Probably the most important item in the vegetable food is corn, and by pulling up the newly sprouted seeds the bird renders himself extremely obnoxious. Observation and experiments with tame crows show that hard, dry corn is never eaten if anything else is to be had, and if fed to nestlings it is soon disgorged. The reason crows resort to newly planted fields is that the kernels of corn are softened by the moisture of the earth, and probably become more palatable in the process of germination, which changes the starch of the grain to sugar. The fact, however, remains that crows eat corn extensively only when it has been softened by germination or partial decay, or before it is ripe and still "in the milk." Experience has shown that they may be prevented from pulling up young corn by tarring the seed, which not only saves the corn but forces them to turn their attention to insects. If

they persist in eating green corn it is not so easy to prevent the damage; but no details of extensive injury in this way have yet been presented, and it is probable that no great harm has been done.

Crows eat fruit to some extent, but confine themselves for the most part to wild species, such as dogwood, sour gum, and seeds of the different kinds of sumac. They have also a habit of sampling almost everything which appears eatable, especially when food is scarce. For example, they eat frozen apples found on the trees in winter, or pumpkins, turnips, and potatoes which have been overlooked or neglected; even mushrooms are sometimes taken, probably in default of something better.

In estimating the economic status of the crow, it must be acknowledged that he does some damage, but, on the other hand, he should receive much credit for the insects which he destroys. In the more thickly settled parts of the country the crow probably does more good than harm, at least when ordinary precautions are taken to protect young poultry and newly-planted corn against his depredations. If, however, corn is planted with no provision against possible marauders, if hens and turkeys are allowed to nest and to roam with their broods at a distance from farm buildings, losses must be expected.

THE BOBOLINK, OR RICEBIRD.

(*Dolichonyx oryzivorus.*)

The bobolink (fig. 9) is a common summer resident of the United States, north of about latitude 40°, and from New England westward to the Great Plains, wintering beyond our southern border. In New England there are few birds, if any, around which so much romance has clustered; in the South none on whose head so many maledictions have been heaped. The bobolink, entering the United States from the South at a time when the rice fields are freshly sown, pulls up the young plants and feeds upon the seed. Its stay, however, is not long, and it soon hastens northward, where it is welcomed as a herald of summer. During its sojourn in the Northern States it feeds mainly upon insects and small seeds of useless plants; but while rearing its young, insects constitute its chief food, and almost the exclusive diet of its brood. After the young are able to fly, the whole family gathers into a small flock and begins to live almost entirely upon vegetable food. This consists for the most part of weed seeds, since in the North these birds do not appear to molest grain to any great extent. They eat a few oats, but their stomachs do not reveal a great quantity of this or any other grain. As the season advances they gather into larger flocks and move southward, until by the end of August nearly all have left their breeding grounds. On their way they frequent the reedy marshes about the mouths of rivers and on the inland waters of the coast region, subsisting largely upon wild rice. After leaving the Northern States they are commonly known as reed birds, and having become very fat are treated as game.

They begin to arrive on the rice fields in the latter part of August, and during the next month make havoc in the ripening crop. It is unfortunate that the rice districts lie exactly in the track of their fall migration, since the abundant supply of food thus offered has undoubtedly served to attract them more and more, until most of the bobolinks bred in the North are concentrated with disastrous effect on the south east coast when the rice ripens in the fall. There was evidently a time when no such supply of food awaited the birds on their journey southward, and it seems probable that the introduction of rice culture in the South, combined with the clearing of the forests in the North, thus affording a larger available breeding area, has favored an increase in the

FIG. 9.—Bobolink.

numbers of this species. The food habits of the bobolink are not necessarily inimical to the interests of agriculture. It simply happens that the rice affords a supply of food more easily obtainable than did the wild plants which formerly occupied the same region. Were the rice fields at a distance from the line of migration, or north of the bobolinks' breeding ground, they would probably never be molested; but lying, as they do, directly in the path of migration, they form a recruiting ground, where the birds can rest and accumulate flesh and strength for the long sea flight which awaits them in their course to South America.

The annual loss to rice growers on account of bobolinks has been estimated at $2,000,000. In the face of such losses it is evident that

no mere poetical sentiment should stand in the way of applying any remedy which can be devised. It would be unsafe to assume that the insects which the birds consume during their residence in the North can compensate for such destruction. If these figures are any approximation to the truth, the ordinary farmer will not believe that the bobolink benefits the Northern half of the country nearly as much as it damages the Southern half, and the thoughtful ornithologist will be inclined to agree with him. But even if the bird really does more harm than good, what is the remedy? For years the rice planters have been employing men and boys to shoot the birds and drive them away from the fields, but in spite of the millions slain every year their numbers do not decrease. In fact, a large part of the loss sustained is not in the grain which the birds actually eat, but in the outlay necessary to prevent them from taking it all. At present there seems to be no effective remedy short of complete extermination of the species, and this is evidently impracticable even were it desirable.

THE REDWINGED BLACKBIRD.

(*Agelaius phœniceus.*)

The redwinged, or swamp, blackbird (fig. 10) is found all over the United States and the region immediately to the north. While common in most of its range, its distribution is more or less local, mainly on account of its partiality for swamps. Its nest is built near standing water, in tall grass, rushes, or bushes. Owing to this peculiarity the bird may be absent from large tracts of country which afford no swamps or marshes suitable for nesting. It usually breeds in large colonies, though single families, consisting of a male with several wives, may sometimes be found in a small slough, where each of the females builds her nest and rears her own little brood, while her liege lord displays his brilliant colors and struts in the sunshine. In the Upper Mississippi Valley it finds the conditions most favorable, for the countless prairie sloughs and the margins of the numerous shallow lakes form nesting sites for thousands of redwings; and there are bred the immense flocks which sometimes do so much damage to the grain fields of the West. After the breeding season is over, the birds collect in flocks to migrate, and remain thus associated throughout the winter.

Many complaints have been made against the redwing, and several States have at times placed a bounty upon its head. It is said to cause great damage to grain in the West, especially in the Upper Mississippi Valley; and the rice growers of the South say that it eats rice. No complaints have been received from the Northeastern portion of the country, where the bird is much less abundant than in the West and South.

An examination of 725 stomachs showed that vegetable matter forms 74 per cent of the food, while the animal matter, mainly insects, forms

but 26 per cent. A little more than 10 per cent consists of beetles, mostly harmful species. Weevils, or snout beetles, amount to 4 per cent of the year's food, but in June reach 25 per cent. As weevils are among the most harmful insects known, their destruction should condone for at least some of the sins of which the bird has been accused. Grasshoppers constitute nearly 5 per cent of the food, while the rest of the animal matter is made up of various insects, a few snails, and crustaceans. Several dragon flies were found, but these were probably picked up dead, for they are too active to be taken alive, unless by one of the flycatchers. So far as the insect food as a whole is concerned, the redwing may be considered entirely beneficial.

The interest in the vegetable food of this bird centers around the

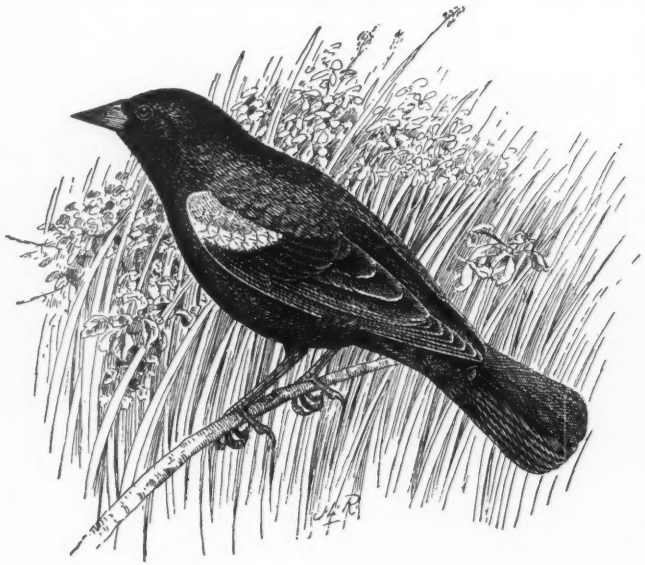

FIG. 10.—Redwinged blackbird.

grain. Only three kinds, corn, wheat, and oats, were found in appreciable quantities in the stomachs, and they aggregate but little more than 13 per cent of the whole food, oats forming nearly half of this amount. In view of the many complaints that the redwing eats grain, this record is surprisingly small. The crow blackbird has been found to eat more than three times as much. In the case of the crow, corn forms one-fifth of the food, so that the redwinged blackbird, whose diet is made up of only a trifle more than one-eighth of grain, is really one of the least destructive species; but the most important item of this bird's food is weed seed, which forms practically the whole food in winter and about 57 per cent of the whole year's fare. The principal weed seeds

eaten are those of ragweed, barn grass, smartweed, and about a dozen others. That these seeds are preferred is shown by the fact that the birds begin to eat them in August, when grain is still readily accessible, and continue feeding on them even after insects become plentiful in April. The redwing eats very little fruit and does practically no harm in the garden or orchard.

While it is impossible to dispute the mass of testimony which has accumulated concerning its grain-eating propensity, the stomach examinations show that the habit must be local rather than general. As the area of cultivation increases and the breeding grounds are curtailed, the species is likely to become reduced in numbers and consequently less harmful. Nearly seven-eighths of the redwing's food is made up of weed seed or of insects injurious to agriculture, indicating unmistakably that the bird should be protected, except, perhaps, in a few places where it is too abundant.

THE MEADOW LARK, OR OLD FIELD LARK.

(Sturnella magna.)

The meadow lark (fig. 11) is a common and well-known bird occurring from the Atlantic Coast to the Great Plains, where it gives way to a closely related subspecies, which extends thence westward to the Pacific. It winters from our southern border as far north as the District of Columbia, southern Illinois, and occasionally Iowa. Although it is a bird of the plains, finding its most congenial haunts in the prairies of the West, it does not disdain the meadows and mowing lands of New England. It nests on the ground and is so terrestrial in its habits that it seldom perches on trees, preferring a fence rail or a telegraph pole. When undisturbed, it may be seen walking about with a peculiar dainty step, stopping every few moments to look about and give its tail a nervous flirt or to sound a note or two of its clear whistle.

The meadow lark is almost wholly beneficial, although a few complaints have been made that it pulls sprouting grain, and one farmer claims that it eats clover seed. As a rule, however, it is looked upon with favor and is not disturbed.

In the 238 stomachs examined, animal food (practically all insects) constituted 73 per cent of the contents and vegetable matter 27 per cent. As would naturally be supposed, the insects were ground species, such as beetles, bugs, grasshoppers, and caterpillars, with a few flies, wasps, and spiders. A number of the stomachs were taken from birds that had been killed when the ground was covered with snow, but still they contained a large percentage of insects, showing the bird's skill in finding proper food under adverse circumstances.

Of the various insects eaten, crickets and grasshoppers are the most important, constituting 29 per cent of the entire year's food and 69 per cent of the food in August. It is scarcely necessary to enlarge upon

this point, but it can readily be seen what an effect a number of these birds must have on a field of grass in the height of the grasshopper season. Of the 238 stomachs collected at all seasons of the year, 178, or more than two-thirds, contained remains of grasshoppers, and one was filled with fragments of 37 of these insects. This seems to show conclusively that grasshoppers are preferred and are eaten whenever they can be procured. The great number taken in August is especially noticeable. This is essentially the grasshopper month, i. e., the month when grasshoppers reach their maximum abundance; and the stomach examination has shown that a large number of birds resort to this diet in August, no matter what may be the food during the rest of the year.

Next to grasshoppers, beetles make up the most important item of the meadow lark's food, amounting to nearly 21 per cent, of which about one-third are predaceous ground beetles. The others are all harmful

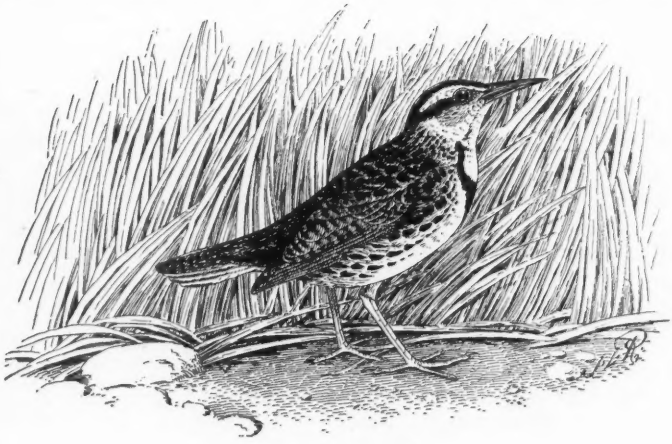

FIG. 11.—Meadow lark.

species, and when it is considered that the bird feeds exclusively on the ground, it seems remarkable that so few useful ground beetles are eaten. Many of them have a disgusting odor, and possibly this may occasionally save them from destruction by birds, especially when other food is abundant. Caterpillars, too, form a very constant element, and in May constitute over 28 per cent of the whole food. May is the month when the dreaded cutworm begins its deadly career, and then the bird does some of its best work. Most of these caterpillars are ground feeders, and are overlooked by birds which habitually frequent trees; but the meadow lark finds them and devours them by thousands. The remainder of the insect food is made up of a few ants, wasps, and spiders, with a few bugs, including some chinch bugs.

The vegetable food consists of grain, weed, and other hard seeds. Grain in general amounts to 14, and weed and other seeds to 12 per cent.

The grain, principally corn, is mostly eaten in winter and early spring, and must be therefore simply waste kernels; only a trifle is consumed in summer and autumn, when it is most plentiful. No trace of sprouting grain was discovered. Clover seed was found in only six stomachs, and but little in each. Seeds of weeds, principally ragweed, barn grass, and smartweed, are eaten from November to April, inclusive, but during the rest of the year are replaced by insects.

Briefly stated, more than half of the meadow lark's food consists of harmful insects; its vegetable food is composed either of noxious weeds or waste grain, and the remainder is made up of useful beetles or neutral insects and spiders. A strong point in the bird's favor is that, although naturally an insect eater, it is able to subsist on vegetable food, and consequently is not forced to migrate in cold weather any farther than is necessary to find ground free from snow. This explains why it remains for the most part in the United States during winter, and moves northward as soon as the snow disappears from its usual haunts.

There is one danger to which the meadow lark is exposed. As its flesh is highly esteemed the bird is often shot for the table, but it is entitled to all possible protection, and to slaughter it for game is the least profitable way to utilize a valuable species.

THE BALTIMORE ORIOLE.

(Icterus galbula.)

Brilliancy of plumage, sweetness of song, and food habits to which no exception can be taken are some of the striking characteristics of the Baltimore oriole (fig. 12). In summer this species is found throughout the northern half of the United States east of the Great Plains, and is welcomed and loved in every country home in that broad land. In the Northern States it arrives rather late, and is usually first seen, or heard, foraging amidst the early bloom of the apple trees, where it searches for caterpillars or feeds daintily on the surplus blossoms. Its nest commands hardly less admiration than the beauty of its plumage or the excellence of its song. Hanging from the tip of the outermost bough of a stately elm, it is almost inaccessible, and so strongly fastened as to bid defiance to the elements.

By watching an oriole which has a nest one may see it searching among the smaller branches of some neighboring tree, carefully examining each leaf for caterpillars, and occasionally trilling a few notes to its mate. Observation both in the field and laboratory shows that caterpillars constitute the largest item of its fare. In 113 stomachs they formed 34 per cent of the food, and are eaten in varying quantities during all the months in which the bird remains in this country, although the fewest are eaten in July, when a little fruit is also taken. The other insects consist of beetles, bugs, ants, wasps, grasshoppers, and some spiders. The beetles are principally click beetles, the larvæ of which are among the most destructive insects known; and the bugs

include plant and bark lice, both very harmful, but so small and obscure as to be passed over unnoticed by most birds. Ants are eaten mostly in spring, grasshoppers in July and August, and wasps and spiders with considerable regularity throughout the season.

Vegetable matter amounts to only a little more than 16 per cent of the food during the bird's stay in the United States, so that the possibility of the oriole doing much damage to crops is very limited. The bird has been accused of eating peas to a considerable extent, but remains of peas were found in only two stomachs. One writer says that it damages grapes, but none were found. In fact, a few blackberries and

FIG. 12.—Baltimore oriole.

cherries comprised the only cultivated fruit detected in the stomachs, the remainder of the vegetable food being wild fruit and a few miscellaneous seeds.

THE CROW BLACKBIRD, OR GRACKLE.

(*Quiscalus quiscula.*)

The crow blackbird (fig. 13) or one of its subspecies is a familiar object in all of the States east of the Rocky Mountains. It is a resident throughout the year as far north as southern Illinois, and in summer extends its range into British America. In the Mississippi Valley it is one of the most abundant birds, preferring to nest in the artificial groves and windbreaks near farms instead of the natural "timber" which it formerly used. It breeds also in parks and near buildings, often in considerable colonies. Farther east, in New England, it is only locally abundant, though frequently seen in migration. After July it

becomes very rare, or entirely disappears, owing to the fact that it collects in large flocks and retires to some quiet place, where food is abundant and where it can remain undisturbed during the molting season, but in the latter days of August and throughout September it usually reappears in immense numbers before moving southward.

It is evident that a bird so large and so abundant may exercise an important influence upon the agricultural welfare of the country it inhabits. The crow blackbird has been accused of many sins, such as stealing grain and fruit and robbing the nests of other birds; but the farmers do not undertake any war of extermination against it, and, for the most part, allow it to nest about the premises undisturbed. An examination of 2,258 stomachs showed that nearly one-third of its food consists of insects, of which the greater part are injurious. The bird

FIG. 13.—Crow blackbird.

also eats a few snails, crayfishes, salamanders, small fish, and occasionally a mouse. The stomach contents do not indicate that it robs other birds' nests to any great extent, as remains of birds and birds' eggs amount to less than one-half of 1 per cent.

It is, however, on account of its vegetable food that the grackle is most likely to be accused of doing damage. Grain is eaten during the whole year, and during only a short time in summer is other food attractive enough to induce the bird to alter its diet. The grain taken in the winter and spring months probably consists of waste kernels gathered from the stubble. The stomachs do not indicate that the bird pulls sprouting grain; but the wheat eaten in July and August, and the corn eaten in the fall, are probably taken from fields of standing

grain. The total grain consumed during the year constitutes 45 per cent of the whole food, but it is safe to say that at least half is waste grain, and consequently of no value. Although the crow blackbird eats a few cherries and blackberries in their season, and some wild fruit in the fall, it apparently does no damage in this way.

Large flocks of crow blackbirds no doubt do considerable injury to grain crops, and there seems to be no remedy except the destruction of the birds, which is in itself expensive. During the breeding season, however, the species does much good by eating insects and by feeding them to its young, which are reared almost entirely upon this food. The bird does the greatest amount of good in spring, when it follows the plow in search of large grub worms, of which it is so fond that it sometimes literally crams its stomach full of them. The farmer must decide for himself whether or not these birds cause more damage than can be repaid by insect destruction; but when they destroy an entire crop it is no consolation to know that they have already eaten a multitude of insects which, if left alone, would have accomplished the same result.

THE SPARROWS.[1]

Sparrows are not obtrusive birds, either in plumage, song, or action. There are some forty species, with nearly as many subspecies, in North America, but their differences, both in plumage and habits, are in most cases too obscure to be readily recognized, and not more than half a dozen forms are generally known in any one locality. All the species are more or less migratory, but so widely are they distributed that there is probably no part of the country where some can not be found throughout the year.

While sparrows are noted seed eaters, they do not by any means confine themselves to a vegetable diet. During the summer, and especially in the breeding season, they eat many insects, and probably feed their young largely upon the same food. An examination of the stomachs of three species—the song sparrow (*Melospiza*), chipping sparrow (*Spizella socialis*), and field sparrow (*Spizella pusilla*) (fig. 14)—shows that about one-third of the food consists of insects, comprising many injurious beetles, such as snout-beetles or weevils, and leaf-beetles. Many grasshoppers are eaten, and in the case of the chipping sparrow these insects form one eighth of the food. Grasshoppers would seem to be rather large morsels, but the bird probably confines itself to the smaller species; indeed, this is indicated by the fact that the greatest amount (over 36 per cent) is eaten in June, when the larger species are still young and the small species most numerous. Besides the insects already mentioned, many wasps and bugs are taken. Predaceous and parasitic Hymenoptera and predaceous beetles, all useful insects, are

[1]The sparrows here mentioned are all native species. For a full account of the English sparrow, including its introduction, habits, and depredations, see Bull. No. 1 of the Division of Ornithology, published in 1889.

eaten only to a slight extent, so that as a whole the sparrows' insect diet may be considered beneficial.

Their vegetable food is limited almost exclusively to hard seeds This might seem to indicate that the birds feed to some extent upon grain, but the stomachs examined show only one kind—oats—and but little of that. The great bulk of the food is made up of grass and weed seed, which form almost the entire diet during winter, and the amount consumed is immense.

Anyone acquainted with the agricultural region of the Upper Mississippi Valley can not have failed to notice the enormous growth of weeds in every waste spot where the original sward has been disturbed.

FIG. 14.—Field sparrow.

By the roadside, on the borders of cultivated fields, or in abandoned fields, wherever they can obtain a foothold, masses of rank weeds spring up, and often form impenetrable thickets which afford food and shelter for immense numbers of birds and enable them to withstand great cold and the most terrible blizzards. A person visiting one of these weed patches on a sunny morning in January, when the thermometer is 20° or more below zero, will be struck with the life and animation of the busy little inhabitants. Instead of sitting forlorn and half frozen, they may be seen flitting from branch to branch, twittering and fluttering, and showing every evidence of enjoyment and perfect comfort. If one

of them be killed and examined, it will be found in excellent condition—in fact, a veritable ball of fat.

The snowbird (*Junco hyemalis*) and tree sparrow (*Spizella monticola*) are perhaps the most numerous of all the sparrows. The latter fairly swarms all over the Northern States in winter, arriving from the north early in October and leaving in April. Examination of many stomachs shows that in winter the tree sparrow feeds entirely upon seeds of weeds; and probably each bird consumes about one-fourth of an ounce a day. In an article contributed to the New York Tribune in 1881 the writer estimated the amount of weed seed annually destroyed by these birds in the State of Iowa. Upon the basis of one-fourth of an ounce of seed eaten daily by each bird, and supposing that the birds averaged ten to each square mile, and that they remain in their winter range two hundred days, we shall have a total of 1,750,000 pounds, or 875 tons, of weed seed consumed by this one species in a single season. Large as these figures may seem, they certainly fall far short of the reality. The estimate of ten birds to a square mile is much within the truth, for the tree sparrow is certainly more abundant than this in winter in Massachusetts, where the food supply is less than in the Western States, and I have known places in Iowa where several thousand could be seen within the space of a few acres. This estimate, moreover, is for a single species, while, as a matter of fact, there are at least half a dozen birds (not all sparrows) that habitually feed on these seeds during winter.

Farther south the tree sparrow is replaced in winter by the white-throated sparrow, the white-crowned sparrow, the fox sparrow, the song sparrow, the field sparrow, and several others; so that all over the country there are a vast number of these seed eaters at work during the colder months reducing next year's crop of worse than useless plants.

In treating of the value of birds, it has been customary to consider them mainly as insect destroyers; but the foregoing illustration seems to show that seed eaters have a useful function, which has never been fully appreciated.

THE ROSE-BREASTED GROSBEAK.

(*Zamelodia ludoviciana.*)

The beautiful rose-breasted grosbeak (fig. 15) breeds in the northern half of the United States east of the Missouri River, but spends its winters beyond our boundaries. Unfortunately it is not abundant in New England, and nowhere as plentiful as it should be. It frequents groves and orchards rather than gardens or dooryards, but probably the beauty of the male is the greatest obstacle to its increase; the fully adult bird is pure black and white, with a broad patch of brilliant rose color upon the breast and under each wing. On account of this

attractive plumage the birds are highly prized for ladies' hats; and consequently have been shot in season and out, till the wonder is not that there are so few, but that any remain at all.

When the Colorado potato beetle first swept over the land, and naturalists and farmers were anxious to discover whether or not there were any enemies which would prey upon the pest, the grosbeak was almost the only bird seen to eat the beetles. Further observation confirmed the fact, and there can be no reasonable doubt that where the bird is abundant it has contributed very much to the abatement of the pest which has been noted during the last decade. But this is not the only good which the bird does, for many other noxious insects besides the potato beetle are also eaten.

The vegetable food of the grosbeak consists of buds and blossoms of forest trees, and seeds, but the only damage of which it has been

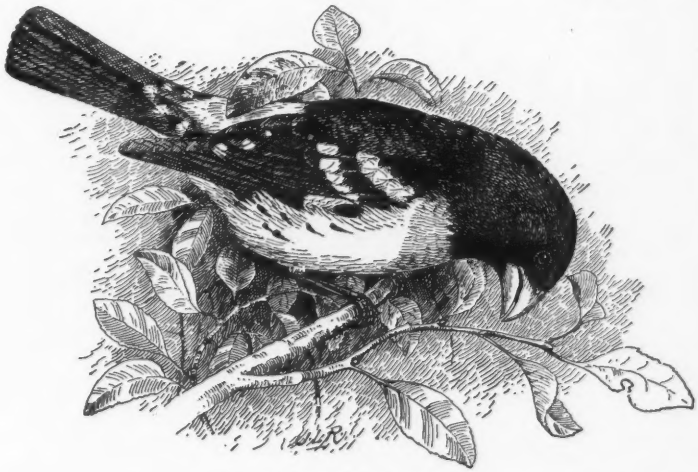

FIG. 15.—Rose-breasted grosbeak.

accused is the stealing of green peas. The writer has observed it eating peas and has examined the stomachs of several that had been killed in the very act. The stomachs contained a few peas and enough potato beetles, old and young, as well as other harmful insects, to pay for all the peas the birds would be likely to eat in a whole season. The garden where this took place adjoined a small potato field which earlier in the season had been so badly infested with the beetles that the vines were completely riddled. The grosbeaks visited the field every day, and finally brought their fledged young. The young birds stood in a row on the topmost rail of the fence and were fed with the beetles which their parents gathered. When a careful inspection was made a few days later, not a beetle, old or young, could be found; the birds had swept them from the field and saved the potatoes.

It is not easy to advise measures either for increasing the numbers of this bird or inducing it to take up its residence on the farm. Naturally it inhabits thin, open woods or groves, and the change from such places to orchards would be simple—in fact, has already been made in some parts of Pennsylvania and Ohio. In New England the bird is somewhat rare, and perhaps the best that can be done here or elsewhere is to see that it is thoroughly protected.

THE SWALLOWS.

There are seven common species of swallows within the limits of the United States, four of which have, to some extent, abandoned their

FIG. 16.—Barn swallow.

primitive nesting habits and attached themselves to the abodes of man. As a group, swallows are gregarious and social in an eminent degree. Some species build nests in large colonies, occasionally numbering thousands; in the case of others only two or three pairs are found together; while still others nest habitually in single pairs.

Their habits are too familiar to require any extended description. Their industry and tirelessness are wonderful, and during the day it is rare to see swallows at rest except just before their departure for the South, when they assemble upon telegraph wires or upon the roofs of buildings, apparently making plans for the journey.

A noticeable characteristic of several of the species is their attachment to man. In the eastern part of the country the barn swallow (*Chelidon erythrogastra*) (fig. 16) now builds exclusively under roofs, having entirely abandoned the rock caves and cliffs in which it formerly nested. More recently the cliff swallow (*Petrochelidon lunifrons*) has found a better nesting site under the eaves of buildings than was afforded by the overhanging cliffs of earth or stone which it once used, and to which it still resorts occasionally in the East, and habitually in the unsettled West. The martin (*Progne subis*) and white-bellied swallow (*Tachycineta bicolor*) nest either in houses supplied for the purpose, in abandoned nests of woodpeckers, or in natural crannies in rocks. The other species have not yet abandoned their primitive habitats, but possibly may do so as the country becomes more thickly settled.

Field observation will convince any ordinarily attentive person that the food of swallows must consist of the smaller insects captured in mid air, or perhaps in some cases picked from the tops of tall grass or weeds. This observation is borne out by an examination of stomachs, which shows that the food consists of many small species of beetles which are much on the wing; many species of Diptera (mosquitoes and their allies), with large quantities of flying ants and a few insects of similar kinds. Most of them are either injurious or annoying, and the numbers destroyed by swallows are not only beyond calculation, but almost beyond imagination.

The white-bellied swallow eats a considerable number of berries of the bayberry, or wax myrtle. During migrations and in winter it has a habit of roosting in these shrubs, and it probably obtains the fruit at that time.

It is a mistake to tear down the nests of a colony of cliff swallows from the eaves of a barn, for so far from disfiguring a building the nests make a picturesque addition, and their presence should be encouraged by every device. It is said that cliff and barn swallows can be induced to build their nests in a particular locality, otherwise suitable, by providing a quantity of mud to be used as mortar. Barn swallows may also be encouraged by cutting a small hole in the gable of the barn, while martins and white-bellied swallows will be grateful for boxes like those for the bluebird, but placed in some higher situation.

THE CEDAR BIRD.

(*Ampelis cedrorum.*)

The cedar waxwing, or cherry bird (fig. 17), inhabits the whole of the United States, but is much less common in the West. Although the great bulk of the species retires southward in winter, the bird is occasionally found in every State during the colder months, especially if wild berries are abundant. Its proverbial fondness for cherries has given rise to its popular name, and much complaint has been made on account of the fruit eaten. Observation has shown, however, that its

depredations are confined to trees on which the fruit ripens earliest, while later varieties are comparatively untouched. This is probably owing to the fact that when wild fruits ripen they are preferred to cherries, and really constitute the bulk of the cedar bird's diet.

In 152 stomachs examined animal matter formed only 13 and vegetable 87 per cent, showing that the bird is not wholly a fruit eater. With the exception of a few snails, all the animal food consisted of insects, mainly beetles—and all but one more or less noxious, the famous elm leaf-beetle being among the number. Bark or scale lice were found in several stomachs, while the remainder of the animal food was made up of grasshoppers, bugs, and the like. Three nestlings were found to have been fed almost entirely on insects.

Of the 87 per cent of vegetable food, 74 consisted entirely of wild fruit or seeds and 13 of cultivated fruit, but a large part of the latter

FIG. 17.—Cedar bird.

was made up of blackberries and raspberries, and it is very doubtful whether they represented cultivated varieties. Cherry stealing is the chief complaint against this bird, but of the 152 stomachs only 9, all taken in June and July, contained any remains of cultivated cherries, and these aggregate but 5 per cent of the year's food. As 41 stomachs were collected in those months, it is evident that the birds do not live to any great extent on cultivated cherries.

Although the cherry bird is not a great insect destroyer, it does some good work in this way, since it probably rears its young mostly upon insect food. On the other hand, it does not devour nearly as much cultivated fruit as has been asserted, and most, if not all, of the damage can be prevented. The bird should therefore be considered a useful species, and as such should be accorded all possible protection.

THE CATBIRD.

(*Galeoscoptes carolinensis.*)

The catbird (fig. 18), like the thrasher, is a lover of swamps, and delights to make its home in a tangle of wild grapevines, greenbriers, and shrubs, where it is safe from attack and can find its favorite food in abundance. It is found throughout the United States west to the Rocky Mountains; occurs also in Washington, Idaho, and Utah, and extends northward into British America. It winters in the Southern States, Cuba, Mexico, and Central America.

The catbird always attracts attention, and the intruder upon its haunts soon understands that he is not welcome. There is no mistaking the meaning of the sneering voice with which he is saluted, and there is little doubt that this gave rise to the popular prejudice against the

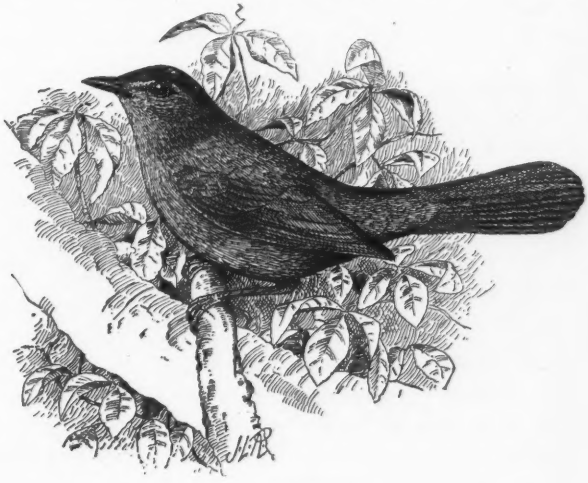

FIG. 18.—Catbird.

bird; but the feeling has been increased by the fact that the species is sometimes a serious annoyance to fruit growers. All such reports, however, seem to come from the prairie country of the West. In New England, according to the writer's experience the catbird is seldom seen about gardens or orchards; the reason may possibly be found in the fact that on the prairies fruit-bearing shrubs which afford so large a part of this bird's food are conspicuously absent. With the settlement of this region comes an extensive planting of orchards, vineyards, and small fruit gardens, which furnish shelter and nesting sites for the catbird, as well as for other species, with a consequent large increase in their numbers, but without providing the native fruits upon which they have been accustomed to feed. Under these circumstances, what is more natural than for the birds to turn to cultivated fruits for their

supplies? The remedy is obvious; cultivated fruits can be protected by the simple expedient of planting wild species or others which are preferred by the birds. Some experiments with catbirds in captivity showed that the Russian mulberry was preferred to any cultivated fruit that could be offered.

The stomachs of 213 catbirds were examined and found to contain 44 per cent of animal (insect) and 56 per cent of vegetable food.[1] Ants, beetles, caterpillars, and grasshoppers constitute three-fourths of the animal food, the remainder being made up of bugs, miscellaneous insects and spiders. One-third of the vegetable food consists of cultivated fruits, or those which may be cultivated, such as strawberries, raspberries, and blackberries; but while we debit the bird with the whole of this, it is probable—and in the eastern and well-wooded part of the country almost certain—that a large part was obtained from wild vines. The rest of the vegetable matter is mostly wild fruit, such as cherries, dogwood, sour gum, elder berries, greenbrier, spice berries, black alder, sumac, and poison ivy.

Although the catbird sometimes does considerable harm by destroying small fruit, the bird can not be considered injurious. On the contrary, in most parts of the country it does far more good than harm, and the evil it does can be reduced appreciably by the methods already pointed out.

THE BROWN THRASHER.

(*Harporhynchus rufus.*)

The brown thrasher (fig. 19) breeds throughout the United States east of the Great Plains, and winters in the south Atlantic and Gulf States. It occasionally visits the garden or orchard, but nests in swamps or in groves standing upon low ground. While it generally prefers a thickly grown retreat, it sometimes builds in a pile of brush at a distance from trees. On account of its more retiring habits it is not so conspicuous as the robin, although it may be equally abundant. Few birds can excel the thrasher in sweetness of song, but it is so shy that its notes are not heard often enough to be appreciated. Its favorite time for singing is the early morning, when, perched on the top of some tall bush or low tree, it gives an exhibition of vocal powers which would do credit to a mockingbird. Indeed, in the South, where the latter bird is abundant, the thrasher is known as the sandy mocker.

The food of the brown thrasher consists of both fruit and insects. An examination of 121 stomachs showed 36 per cent of vegetable and 64 of animal food, practically all insects, and mostly taken in spring before fruit is ripe. Half the insects were beetles, and the remainder chiefly grasshoppers, caterpillars, bugs, and spiders. A few predaceous

[1] The investigation of the food of the catbird, brown thrasher, and house wren was made by Mr. Sylvester D. Judd and published in the Yearbook of the Department of Agriculture for 1895, pp. 405–408.

beetles were eaten, but, on the whole, its work as an insect destroyer may be considered beneficial.

Eight per cent of the food is made up of fruits like raspberries and currants which are or may be cultivated, but the raspberries at least are as likely to belong to wild as to cultivated varieties. Grain, made up mostly of scattered kernels of oats and corn, is merely a trifle, amounting to only 3 per cent, and though some of the corn may be taken from newly planted fields it is amply paid for by the May beetles which are eaten at the same time. The rest of the food consists of wild fruit or seeds. Taken all in all, the brown thrasher is a useful bird, and probably does just as good work in its secluded retreats as

FIG. 19.—Brown thrasher.

it would about the garden, for the swamps and groves are no doubt the breeding grounds of many insects that migrate thence to attack the farmers' crops.

THE HOUSE WREN.

(*Troglodytes aëdon.*)

The diminutive house wren (fig. 20) frequents barns and gardens, and particularly old orchards in which the trees are partially decayed. He makes his nest in a hollow branch where perhaps a woodpecker had a domicile the year before, but he is a pugnacious character, and if he happens to fancy one of the boxes that have been put up for the bluebirds he does not hesitate to take it. He is usually not slow to avail himself of boxes, gourds, tin cans, or empty jars placed for his accommodation.

As regards food habits, the house wren is entirely beneficial. Practically, he can be said to live upon animal food alone, for an examination

of 52 stomachs showed that 98 per cent of the stomach contents was made up of insects or their allies, and only 2 per cent was vegetable, including bits of grass and similar matter, evidently taken by accident with the insects. Half of this food consisted of grasshoppers and beetles; the remainder of caterpillars, bugs, and spiders. As the house wren is a prolific breeder, frequently rearing from twelve to sixteen young in a season, a family of these birds must cause considerable reduction in the number of insects in a garden. Wrens are industrious foragers, searching every tree, shrub, or vine for caterpillars, examining every post and rail of the fence, and every cranny in the wall for insects or spiders. They do not, as a rule, fly far afield, but work

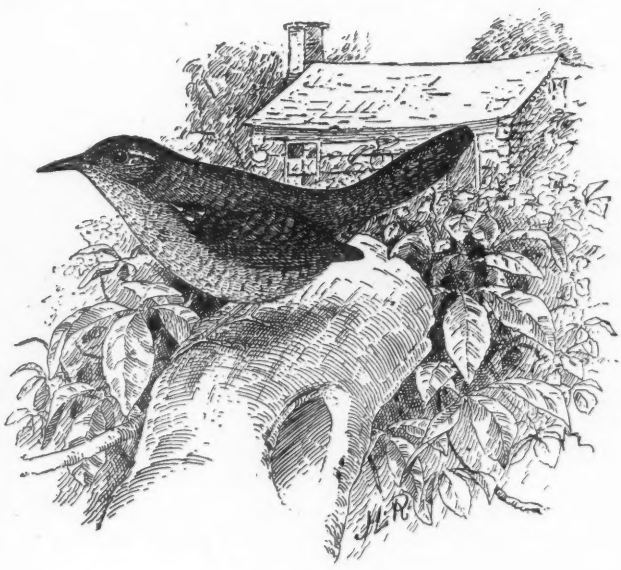

FIG. 20.—House wren.

industriously in the immediate vicinity of their nests. In this way they become valuable aids in the garden or orchard, and by providing suitable nesting boxes they may be induced to take up residence where their services will do most good. Their eccentricities in the selection of a home are well known. Almost anything, from an old cigar box to a tomato can, an old teapot, a worn-out boot, or a horse's skull, is acceptable, provided it be placed well up from the ground and out of reach of cats and other prowlers.

It does not seem possible to have too many wrens, and every effort should be made to protect them and to encourage their nesting about the house.

THE ROBIN.

(*Merula migratoria.*)

The robin (fig. 21) is found throughout the United States east of the Great Plains, and is represented farther west by a slightly different subspecies. It extends far north through Canada, and is found even in Alaska. Although the great bulk of the species leaves the Northern States in winter, a few individuals remain in sheltered swamps, where wild berries furnish an abundant supply of food.

The robin builds its nest in orchards and gardens, and occasionally takes advantage of a nook about the house, or under the shelter of the roof of a shed or outbuilding. Its food habits have sometimes caused apprehension to the fruit grower, for it is fond of cherries and other small fruits, particularly the earlier varieties. For this reason many complaints have been lodged against it, and some persons have gone

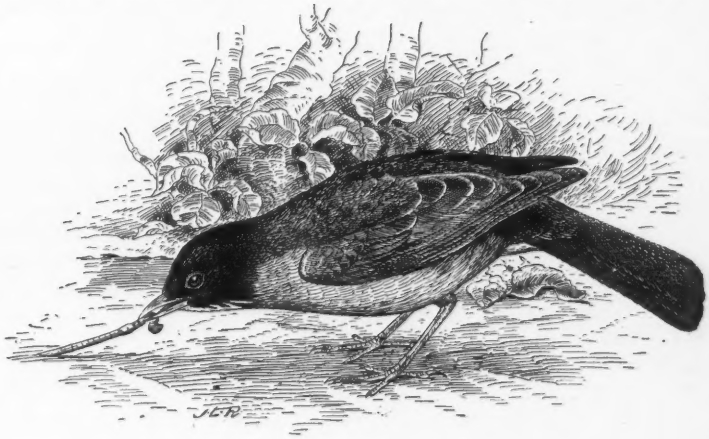

FIG. 21.—Robin.

so far as to condemn the bird. The robin is, however, too valuable to be exterminated, and choice fruit can be readily protected from its depredations.

An examination of 330 stomachs shows that over 42 per cent of its food is animal matter, principally insects, while the remainder is made up largely of small fruits or berries. Over 19 per cent consists of beetles, about one-third of which are useful ground beetles, taken mostly in spring and fall, when other insects are scarce. Grasshoppers make up about one-tenth of the whole food, but in August comprise over 30 per cent. Caterpillars form about 6 per cent, while the rest of the animal food, about 7 per cent, is made up of various insects, with a few spiders, snails, and angle-worms. All the grasshoppers, caterpillars, and bugs, with a large portion of the beetles, are injurious, and it is safe to say that noxious insects comprise more than one-third of the robin's food.

Vegetable food forms nearly 58 per cent of the stomach contents, over 47 being wild fruits, and only a little more than 4 per cent being possibly cultivated varieties. Cultivated fruit amounting to about 25 per cent was found in the stomachs in June and July, but only a trifle in August. Wild fruit, on the contrary, is eaten in every month, and constitutes a staple food during half the year. No less than forty-one species were identified in the stomachs; of these, the most important were four species of dogwood, three of wild cherries, three of wild grapes, four of greenbrier, two of holly, two of elder; and cranberries, huckleberries, blueberries, barberries, service berries, hackberries, and persimmons, with four species of sumac, and various other seeds not strictly fruit.

The depredations of the robin seem to be confined to the smaller and earlier fruits, and few, if any, complaints have been made against it on the score of eating apples, peaches, pears, grapes, or even late cherries. By the time these are ripe the forests and hedges are teeming with wild fruits, which the bird evidently finds more to its taste. The cherry, unfortunately, ripens so early that it is almost the only fruit accessible at a time when the bird's appetite has been sharpened by a long-continued diet of insects, earthworms, and dried berries, and it is no wonder that at first the rich juicy morsels are greedily eaten. In view of the fact that the robin takes ten times as much wild as cultivated fruit, it seems unwise to destroy the birds to save so little. Nor is this necessary, for by a little care both may be preserved. Where much fruit is grown, it is no great loss to give up one tree to the birds; and in some cases the crop can be protected by scarecrows. Where wild fruit is not abundant, a few fruit-bearing shrubs and vines judiciously planted will serve for ornament and provide food for the birds. The Russian mulberry is a vigorous grower and a profuse bearer, ripening at the same time as the cherry, and, so far as observation has gone, most birds seem to prefer its fruit to any other. It is believed that a number of these trees planted around the garden or orchard would fully protect the more valuable fruits.

Many persons have written about the delicate discrimination of birds for choice fruit, asserting that only the finest and costliest varieties are selected. This is contrary to all careful scientific observation. Birds, unlike human beings, seem to prefer fruit like the mulberry, that is sweetly insipid, or that has some astringent or bitter quality like the chokecherry or holly. The so-called black alder (*Ilex verticillata*), which is a species of holly, has bright scarlet berries, as bitter as quinine, that ripen late in October, and remain on the bushes through November, and though frost grapes, the fruit of the Virginia creeper, and several species of dogwood are abundant at the same time, the birds eat the berries of the holly to a considerable extent, as shown by the seeds found in the stomachs. It is moreover a remarkable fact that the wild fruits upon which the birds feed largely are those which man neither gathers for his own use nor adopts for cultivation.

THE BLUEBIRD.

(*Sialia sialis.*)

The common and familiar bluebird (fig. 22) is an inhabitant of all the States east of the Rocky Mountains from the Gulf of Mexico northward into Canada. It winters as far north as southern Illinois, in the Mississippi Valley, and Pennsylvania in the east; in spring it is one of the first migrants to arrive in the Northern States, and is always welcomed as an indication of the final breaking up of winter. It frequents orchards and gardens, where it builds its nest in hollow trees, or takes advantage of a nesting box provided by the enterprising farmer's boy.

So far as known, this bird has not been accused of stealing fruit or of preying upon any crops. An examination of 205 stomachs showed

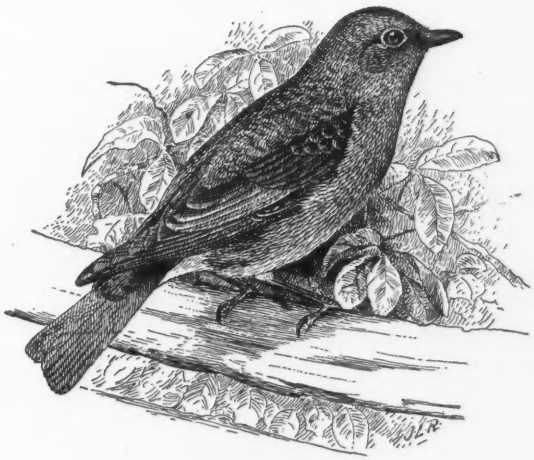

FIG. 22.—Bluebird.

that 76 per cent of the food consists of insects and their allies, while the other 24 per cent is made up of various vegetable substances, found mostly in stomachs taken in winter. Beetles constitute 28 per cent of the whole food, grasshoppers 22, caterpillars 11, and various insects, including quite a number of spiders, comprise the remainder of the insect diet. All these are more or less harmful, except a few predaceous beetles, which amount to 8 per cent, but in view of the large consumption of grasshoppers and caterpillars, we can at least condone this offense, if such it may be called. The destruction of grasshoppers is very noticeable in the months of August and September, when these insects form more than 60 per cent of the diet.

It is evident that in the selection of its food the bluebird is governed more by abundance than by choice. Predaceous beetles are eaten in

spring, as they are among the first insects to appear; but in early summer caterpillars form an important part of the diet, and are replaced a little later by grasshoppers. Beetles are eaten at all times, except when grasshoppers are more easily obtained.

So far as its vegetable food is concerned, the bluebird is positively harmless. The only trace of any useful product in the stomachs consisted of a few blackberry seeds, and even these more probably belonged to wild than cultivated varieties. Following is a list of the various seeds which were found: Blackberry, chokeberry, juniperberry, poke, berry, partridgeberry, greenbriar, Virginia creeper, bittersweet, holly, strawberry bush, false spikenard, wild sarsaparilla, sumac (several species), rose haws, sorrel, ragweed, grass, and asparagus. This list shows how little the bluebird depends upon the farm or garden to supply its needs, and indicates that by encouraging the growth of some of these plants, many of which are highly ornamental, the bird can be induced to make its home on the premises.

Bluebirds are so well known that it seems unnecessary to urge anything more in their favor; but in view of the fact that large numbers were destroyed during the severe storm of 1895, more than ordinary vigilance should be exercised in protecting them until they have regained their normal abundance.

Cop. 3

U. S. DEPARTMENT OF AGRICULTURE.

FARMERS' BULLETIN No. 54.

SOME COMMON BIRDS

IN THEIR RELATION TO AGRICULTURE.

BY

F. E. L. BEAL, B. S.,

Assistant in Charge Economic Ornithology, Biological Survey.

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1904.

LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BIOLOGICAL SURVEY,
Washington, D. C., February 13, 1904.

SIR: I have the honor to transmit herewith, and to recommend for publication, a new and revised edition of Farmers' Bulletin No. 54, Some Common Birds in Their Relation to Agriculture, by F. E. L. Beal, Assistant in Charge of Economic Ornithology, Biological Survey. The first edition of this bulletin has proved so popular that since May, 1897, the date of publication, 330,000 copies have been distributed. Additional material on the food habits of several western birds is incorporated in the present edition.

Respectfully,

C. HART MERRIAM,
Chief, Biological Survey.

HON. JAMES WILSON,
Secretary of Agriculture.

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SOME COMMON BIRDS IN THEIR RELATION TO AGRICULTURE.

INTRODUCTION.

While it has long been known that birds play an important part in relation to agriculture, there seems to be a tendency to dwell on the harm they do rather than on the good. Whether a bird is injurious or beneficial depends almost entirely upon what it eats. In the case, therefore, of species which are unusually abundant or which depend in part for subsistence upon the crops of the farmer, the character of their food often becomes a very practical question. If crows or blackbirds are seen in numbers about cornfields, or if woodpeckers are noticed at work in an orchard, it is perhaps not surprising that they are accused of doing harm. Careful investigation, however, often shows that they are actually destroying noxious insects; and also that even those which do harm at one season may compensate for it by eating insect pests at another. Insects are eaten at all times by the majority of land birds. During the breeding season most kinds subsist largely on this food, and rear their young exclusively upon it. When insects are unusually plentiful, they are eaten by many birds which ordinarily do not touch them. Even birds of prey resort to this diet. When insects are more easily obtained than other fare, the smaller hawks and owls live on them almost entirely. This was well illustrated during the plague of Rocky Mountain locusts in the Western States when it was found that locusts were eaten by nearly every bird in the region, and that they formed almost the entire food of a large majority of the species.

Within certain limits birds feed upon the kind of food that is most accessible. Thus, as a rule, insectivorous birds eat the insects that are most easily obtained, provided they do not have some peculiarly disagreeable property. It is not probable that a bird habitually passes by one kind of insect to look for another which is more appetizing; and there seems little evidence in support of the theory that the selection of food is restricted to any particular species of insect, for it is evident that a bird eats those which by its own method of seeking are most easily obtained. Thus, a ground-feeding bird eats the insects it

finds among the dead leaves and grass; a flycatcher, watching for its prey from some vantage point, captures entirely different kinds; and the woodpecker, and the warbler in the tree top select still others. It is thus apparent that a bird's diet is likely to be quite varied, and to differ at different seasons of the year.

In investigating the food habits of birds, field observation can be relied on to a limited extent only, for it is not always easy by watching to determine what a bird really eats. In order to be positive on this point it is necessary to examine the contents of the stomach. When birds are suspected of doing injury to field crops or fruit trees, a few individuals should be shot and their stomachs examined. This will show unmistakably whether or not the birds are guilty.

In response to a general demand for definite information regarding the food habits of our native birds, the Biological Survey of the Department of Agriculture has conducted for some years past a systematic investigation of the food of species which are believed to be of economic importance. Thousands of birds' stomachs have been carefully examined in the laboratory, and all the available data respecting the food of the various species have been brought together. The results of the investigations relating to birds of prey, based on an examination of nearly 3,000 stomachs, were published in 1893 in a special bulletin entitled "The Hawks and Owls of the United States." Many other species have been similarly studied and the results published, either in bulletins or as articles in the Yearbooks. The present bulletin contains abstracts of the results of food studies of about 54 grain and insect eating birds belonging to 14 different families.[a]

These species comprise among others the crow blackbirds and ricebirds, against which serious complaints have been made on account of the damage they do to corn, wheat, rice, and other crops; and also the cuckoos, grosbeaks, and thrashers, which are generally admitted to be beneficial, but whose true value as insect destroyers has not been fully appreciated. The practical value of birds in controlling insect pests should be more generally recognized. It may be an easy matter to exterminate the birds in an orchard or grain field, but it is an extremely difficult one to control the insect pests. It is certain, too, that the value of our native sparrows as weed destroyers is not appreciated.

[a] The limits of this bulletin preclude giving more than a very brief statement regarding the food of each bird, but more detailed accounts of some of the species will be found in the following reports of the Biological Survey (formerly Division of Ornithology and Mammalogy): The Cuckoos—Bulletin No. 9, 1898, pp. 1–14; Crow—Bulletin No. 6, 1895, pp. 1–98; Woodpeckers—Bulletin No. 7, 1895, pp. 1–39; Kingbird—Annual Report Secretary of Agriculture for 1893, pp. 233–234; Redwinged Blackbird—Yearbook for 1897, pp. 349–351; Baltimore Oriole—Yearbook for 1895, pp. 426–430; Grackles—Yearbook for 1894, pp. 233–248; Meadowlark—Yearbook for 1895, pp. 420–426; Cedarbird—Annual Report Secretary of Agriculture for 1892, pp 197–200; Catbird, Brown Thrasher, and Wren—Yearbook for 1895, pp. 405–418.

Weed seed forms an important item of the winter food of many of these birds, and it is impossible to estimate the immense numbers of noxious weeds which are thus annually destroyed.

If birds are protected and encouraged to nest about the farm and garden, they will do their share in destroying noxious insects and weeds. A few hours spent in putting up boxes for bluebirds, martins, and wrens will prove a good investment. In many States birds are protected by law. It remains for agriculturists to see that the laws are observed.

THE QUAIL OR BOBWHITE (Colinus virginianus).

The quail of the North, or partridge of the South, and bobwhite of everywhere, is a well-known bird throughout most of the United States east of the Rocky Mountains. In New England, owing to the high esteem in which its flesh is held as food, which results in much hunting, and to the severity of the winters, the bird is not abundant, or, at most, only locally so. It often attains to a fair degree of plentifulness until some unusually hard winter with an uncommon amount of snow destroys nearly the whole stock, owing to their food supply being buried out of reach beneath the snow. Farther south, and in sections where there is less snowfall, bobwhite thrives in spite of any degree of cold. If the forces of nature were its only enemies in such localities, it would seldom die except from old age. Ever since the first settlement of the country this bird has been held in great estimation as an object of sport, and its flesh has been highly valued for food. It has remained for a later generation to determine that however useful it may be for these two purposes, it is of far greater value when alive and roaming freely about the farm.

The food of the quail has been carefully studied by Dr. Sylvester Dwight Judd, of the Biological Survey, with results that will doubtless surprise many people. Speaking of 13 birds which he shot, he says:

> These 13 had taken weed seed to the extent of 63 per cent of their food. Thirty-eight per cent was ragweed, 2 per cent tick-trefoil, partridge pea, and locust seeds, and 23 per cent seeds of miscellaneous weeds such as pigweed, sheep sorrel, Pennsylvania persicaria, climbing false buckwheat, trumpet creeper, paspalum, jewel weed, and pigeon grass. Though the stomachs and crops were not well filled, the birds had eaten 5,582 weed seeds. One crop contained 400 pigweed seeds, another 500 seeds of ragweed. * * * One bobwhite, in addition to other food, had consumed 550 seeds of sheep sorrel, another 640 seeds of pigeon grass, and several 50 to 100 seeds of jewel weed.[a]

About 14 per cent of the quail's food for the year consists of animal matter (insects and their allies). Prominent among these are the Colorado potato beetle, the striped squash beetle, the cotton boll wee-

[a] Birds of a Maryland Farm, a local study of Economic Ornithology, by Sylvester D. Judd, Ph.D., Assistant, Biological Survey, 1902.

vil, the chinch bug, grasshoppers, cutworms, and other pests of agriculture. As the quail subsists on vegetable matter during the late fall, winter, and early spring, it is evident that during the height of the insect season it must feed almost entirely upon these creatures in order that they should constitute 14 per cent of its food. Professor Forbes of Illinois found one stomach nearly filled with chinch bugs. The large green tobacco worms are also eaten.

As a weed destroyer the quail has few, if any, superiors. Moreover, its habits are such that it is almost constantly on the ground, where it is brought in close contact with both weed seeds and ground-living insects. It is a good ranger, and, if undisturbed, will patrol every day all the fields in its vicinity as it searches for food. Take it all in all, there is no more valuable bird to be allowed alive and free upon the farm. Yet too many farmers value their quail only because they can kill them in the fall and sell their bodies for a few dollars.

THE MOURNING DOVE (Zenaidura macroura).

The mourning dove is found throughout the United States, though not abundantly in New England. While by nature it lives in groves or open fields where there are a few trees, it also breeds on the bare prairie, where, in the absence of trees and bushes, it nests on the ground. Although fairly abundant in many parts of the country, it is not a rapid breeder, and where it is treated as game the stock is easily depleted. The dove rears but two young at a time, and even when more than one brood is raised in the year, it can by no means compete in fecundity with the quail, which raises from 12 to 20 young at a laying, and sometimes has two such in the course of the season.

The food of the dove consists of seeds of weeds, together with some grain. The examination of the contents of 237 stomachs shows that over 99 per cent of the food consists wholly of vegetable matter, less than 1 per cent being animal. Wheat, oats, rye, corn, barley, and buckwheat were found in 150 of the stomachs, and constituted 32 per cent of the total food. However, three-fourths of this amount was waste grain picked up in the fields after the harvesting was over. Of the various grains eaten, wheat is the favorite, and is almost the only one taken when in good condition. Most of it was eaten in the months of July and August. Corn, the second in amount, was all old, damaged grain, taken from the fields after the harvest or from roads or stock yards in summer. The principal and almost constant diet, however, is the seeds of weeds. These are eaten at all seasons of the year. They constitute 64 per cent of the annual food supply, and show very little variation during any month. Some of the seeds eaten were so minute that it seemed that none but the smallest species of birds would eat them, and then only when driven to do so by lack

of other food. Some instances of the enormous numbers of seeds that individual birds consumed will be of interest. In one stomach were found 7,500 seeds of the yellow wood-sorrel (*Oxalis stricta*), in another 6,400 seeds of barn grass or foxtail (*Chætochloa*), and in a third the following:

	Seeds.
Slender paspalum (*Paspalum setaceum*)	2,600
Orange hawkweed (*Hieracium aurantiacum*)	4,820
Hoary vervain (*Verbena stricta*)	950
Carolina cranesbill (*Geranium carolinianum*)	120
Yellow wood-sorrel (*Oxalis stricta*)	50
Panic grass (*Panicum* sp.)	620
Other weeds of various kinds	40
Total	9,200

None of the foregoing are useful plants, and most of them are noxious weeds.

This record of weed destruction can hardly be excelled. The dove does not eat insect or other animal food so far as is known. The few traces of insects found in the stomachs are believed to be the remains of weevils contained in seeds which the birds had eaten. In some States the dove is treated as a game bird, with an open season. In California doves may be shot from July 1 to February 15. In this case the season opens too soon, for the writer saw a dove sitting as late as August 12. It would seem that September 1 would be a better time to begin the shooting. In most parts of the country the dove should be entirely protected, especially throughout the Mississippi Valley, where weeds are produced in such abundance.

THE CUCKOOS (Coccyzus americanus and C. erythrophthalmus).

Two species of cuckoos, the yellow-billed (fig. 1) and the black-billed, are common in the United States east of the Plains, and a subspecies of the yellow-billed extends westward to the Pacific. While the two species are quite distinct, they do not differ greatly in food habits, and their economic status is practically the same.

An examination of 155 stomachs has shown that these cuckoos are much given to eating caterpillars, and, unlike most birds, do not reject those covered with hair. In fact, cuckoos eat so many hairy caterpillars that the hairs pierce the inner lining of the stomach and remain there, so that when the stomach is opened and turned inside out, it appears to be lined with a thin coating of fur.

An examination of the stomachs of 46 black-billed cuckoos, taken during the summer months, showed the remains of 906 caterpillars, 44 beetles, 96 grasshoppers, 100 sawflies, 30 stink bugs, and 15 spiders. In all probability more individuals than these were represented, but their remains were too badly broken for recognition. Most of the cater-

pillars were hairy, and many of them belonged to a genus that lives in colonies and feeds on the leaves of trees, including the apple tree. One stomach was filled with larvæ of a caterpillar belonging to the same genus as the tent caterpillar, while others contained that species. Other larvæ were those of large moths, for which the bird seems to have a special fondness. The beetles were mainly click beetles and weevils, with a few May beetles. The saw-flies were all found in two stomachs, one of which contained no less than 100 in the larval stage.

Of the yellow-billed cuckoo, 109 stomachs collected from May to October, inclusive, were examined. The contents consisted of 1,865 caterpillars, 93 beetles, 242 grasshoppers, 37 sawflies, 69 bugs, 6 flies, and 86 spiders. Most of the caterpillars belonged to hairy species and many of them were of large size. One stomach contained 250 American tent caterpillars; another 217 fall webworms. In places where tent caterpillars are abundant, they seem to constitute a large portion of the food of these two birds. The beetles were distributed among several families, but all were more or less harmful to agriculture. In the same stomach which contained the tent caterpillars were two Colorado potato beetles; in another were three goldsmith beetles and remains of several other large beetles. Besides grasshoppers there were several katydids and tree crickets. The sawflies were in the larval stage, in which they resemble caterpillars so closely that they are commonly called false caterpillars; and perhaps this likeness may be the reason the cuckoos eat them so freely. The bugs consisted of stink bugs and cicadas or dog-day harvest flies, with the single exception of one wheel bug, which was the only useful insect eaten, unless the spiders are counted as such.

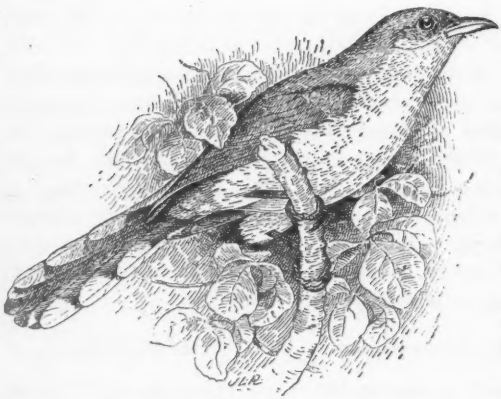

FIG. 1.—Yellow-billed cuckoo.

THE WOODPECKERS.

Five or six species of woodpeckers are familiarly known throughout the eastern United States, and in the West are replaced by others of similar habits. Several species remain in the Northern States through the entire year, while others are more or less migratory.

Farmers are prone to look upon woodpeckers with suspicion. When the birds are seen scrambling over fruit trees and pecking holes in the bark, it is concluded that they are doing harm. Careful observers, however, have noticed that, excepting a single species, these birds rarely leave any conspicuous mark on a healthy tree, except when it is affected by wood-boring larvæ, which are accurately located, dislodged, and devoured by the woodpecker

FIG. 2.—Hairy woodpecker.

Two of the best known woodpeckers, the hairy woodpecker (*Dryobates villosus*—fig. 2) and the downy woodpecker (*D. pubescens*), including their races, range over the greater part of the United States. They differ chiefly in size, their colors being practically the same. The males, like those of many other woodpeckers, are distinguished by a scarlet patch on the head. An examination of many stomachs of these two birds shows that from two-thirds to three-fourths of the

food consists of insects, chiefly noxious. Wood-boring beetles, both adults and larvæ, are conspicuous, and with them are associated many caterpillars, mostly species that burrow into trees. Next in importance are the ants that live in decaying wood, all of which are sought by woodpeckers and eaten in great quantities. Many ants are particularly harmful to timber, for if they find a small spot of decay in the vacant burrow of some woodborer, they enlarge the hole, and as their colony is always on the increase, continue to eat away the wood until the whole trunk is honeycombed. Moreover, these insects are not accessible to other birds, and could pursue their career of destruction unmolested were it not for the woodpeckers, whose beaks and tongues are especially fitted for digging out and devouring them. It

FIG. 3.—Flicker.

is thus evident that woodpeckers are great conservators of forests. To them, more than to any other agency, we owe the preservation of timber from destructive insects.

One of the large woodpeckers familiar to everyone is the flicker, or golden-winged woodpecker (*Colaptes auratus*—fig. 3), which is generally distributed throughout the United States from the Atlantic Coast to the Rocky Mountains. It is there replaced by the red-shafted flicker (*C. cafer collaris*), which extends westward to the Pacific. The two species are as nearly identical in food habits as their respective environments will allow. The flickers, while genuine woodpeckers, differ somewhat in habits from the rest of the family, and are frequently seen searching for food upon the ground. Like the downy and hairy woodpeckers, they feed upon wood-boring grubs and ants, but the

number of ants eaten is much greater than that eaten by the other two species. Of the flickers' stomachs examined, three were completely filled with ants. Two of these each contained more than 3,000 individuals, while the third contained fully 5,000. These ants belong to species which live in the ground. It is these insects for which the flicker is searching when it runs about in the grass, although some grasshoppers also are then taken. The habit of the flicker of pecking holes in buildings sometimes greatly annoys his human friends. This habit is particularly noticeable in the California species. Observation has shown that the object of the work is to obtain shelter for the winter. In the East most of the flickers are migratory, and only a few remain at the North where a shelter is necessary. These generally find a safe retreat in the hollow tree in which they nested. In California, however, where the birds do not migrate, trees are not as abundant as in the East, and so buildings are brought into requisition and holes are drilled, usually under the eaves, where a snug retreat for the night is found. Often a dozen holes may be seen in one building. Barns or other outbuildings are usually selected, though a church is sometimes used.

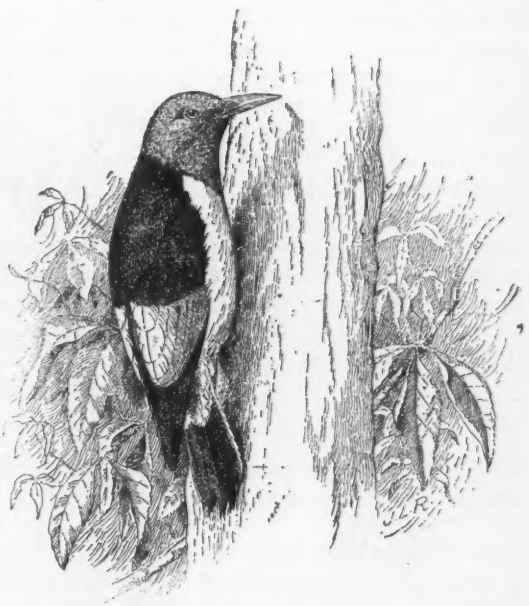

FIG. 4.—Red-headed woodpecker.

The red-headed woodpecker (*Melanerpes erythrocephalus*—fig. 4) is well known east of the Rocky Mountains, but is rather rare in New England. Unlike some of the other species, it prefers fence posts and telegraph poles to trees as a foraging ground. Its food therefore naturally differs from that of the preceding species, and consists largely of adult beetles and wasps, which it frequently captures on the wing, after the fashion of flycatchers. Grasshoppers also form an important part of the food. The redhead has a peculiar habit of selecting very large

beetles, as shown by the presence of fragments of several of the largest species in the stomachs examined. Among the beetles were quite a number of predaceous ground species and some tiger beetles, which are useful insects. The redhead has been accused of robbing the nests of other birds, and of pecking out the brains of young birds and poultry; but as the stomachs showed little evidence to substantiate this charge, it is probable that the habit is exceptional.

The custom was to speak of the smaller woodpeckers as "sapsuckers," under the belief that they drilled holes in trees for the purpose

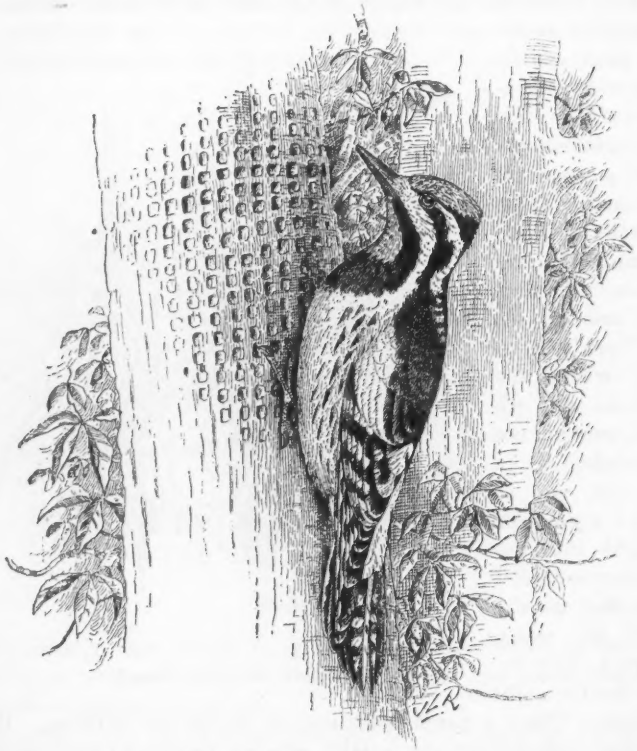

FIG. 5.—Yellow-bellied woodpecker.

of drinking the sap and eating the inner bark. Close observation, however, fastened this habit upon only one species, the yellow-bellied woodpecker, or sapsucker (*Sphyrapicus varius*—fig. 5). This bird was shown to be guilty of pecking holes in the bark of various forest trees, and sometimes in that of apple trees, and of drinking the sap when the pits became filled. It has been proved, however, that besides taking the sap the bird captures large numbers of insects which are attracted by the sweet fluid, and that these form a very

considerable portion of its diet. In some cases the trees are injured by being thus punctured, and die in a year or two, but since comparatively few are touched, the damage is not great. It is probable, moreover, that the bird fully compensates for this injury by the insects it consumes.

The vegetable food of woodpeckers is varied, but consists largely of small fruits and berries. The downy and hairy woodpeckers eat such fruits as dogwood and Virginia creeper, together with the seeds of poison ivy, sumac, and a few other shrubs. The flicker also eats a great many small fruits and the seeds of a considerable number of shrubs and weeds. None of the three species is much given to eating cultivated fruits or crops. The redhead has been accused of eating the larger kinds of fruit, such as apples, and also of taking considerable corn. The stomach examinations show that to some extent these charges are substantiated, but that the habit is not prevalent enough to cause much damage. The bird is quite fond of mast, especially beechnuts, and when these nuts are plentiful it remains north all winter, instead of migrating, as is its usual custom. Half the food of the sapsucker, aside from sap, consists of vegetable matter, largely berries of the kinds already mentioned, and also a quantity of the inner bark of trees, more of which is eaten by this species than by any other.

The woodpeckers seem the only agents which can successfully cope with certain insect enemies of the forests, and, to some extent, with those of fruit trees also. For this reason, if for no other, they should be protected in every possible way.

THE NIGHTHAWK (Chordeiles virginianus).

The nighthawk, or bull-bat, may be seen most often soaring high in air in the afternoon or early evening. It nests upon rocks or bare knolls and flat city roofs.

Its food consists of insects taken on the wing; and so greedy is the bird that when food is plentiful, it fills its great stomach almost to bursting. To ascertain the character of the food taken nearly 100 stomachs were examined, with interesting results. One of the most conspicuous elements was flying ants. Remains of these were found in 36 stomachs, in 24 of which the number ranged from 200 to 1,800. While ants have at times a useful function, they are for the most part annoying and harmful insects. It is evident that they would be much more numerous than they are were not their ranks so severely thinned by the attacks of the nighthawks. Moreover, these ants are killed at the most important epoch of their lives, when they are preparing to propagate their kind, and when the death of every female means the loss of hundreds, or perhaps thousands, of the next generation. In this work nighthawks rank next to, or even with, the woodpeckers, the acknowledged ant-eaters among birds. It is estimated that the 87

stomachs examined contained not less than 20,000 ants; and these were not half of the insect contents. Grasshoppers are another important article of the nighthawk's diet. One stomach contained the remains of 60 individuals, probably the refuse of several meals, as the jaws of the insects were the principal remains. Another stomach contained 38, another 22, and still another 19. The last were mostly entire. They serve to show how much the stomach of a nighthawk can hold. Many other stomachs contained smaller numbers of these insects. May-beetles (Lachnosterna) were found in a number of stomachs. One held the remains of 34, another 23, and a third 17. Several other stomachs contained less numbers. Besides these, many other injurious or annoying insects were found, but mostly in smaller quantities. One bird had eaten three Colorado potato beetles; several had taken both the striped and spotted squash beetles. Many other less known but injurious beetles were found, one stomach containing no less than 17 different species. Bugs of the chinch-bug family were found in very considerable numbers, though the chinch bug itself was not observed. Leaf hoppers were also eaten in considerable numbers. Many stomachs were nearly filled with some soft-bodied, dipterous insects, allied to mosquitoes, but not further identified.

From these glimpses of the food habits of the nighthawk it is evident that it is one of our most useful birds.

THE KINGBIRD (Tyrannus tyrannus).

The kingbird (fig. 6) is essentially a lover of the orchard. It breeds in the States east of the Rocky Mountains, and less commonly in the Great Basin and on the Pacific coast. Its antipathy for hawks and crows is well known, and for this reason a family of kingbirds is a desirable adjunct to a poultry yard. On one occasion within the knowledge of the writer a hawk which attacked a brood of young turkeys was pounced upon and so severely buffeted by a pair of kingbirds whose nest was near by that the would-be robber was glad to escape without his prey. Song birds that nest near the kingbird are similarly protected.

In its food habits the kingbird is largely insectivorous. It is a true flycatcher by nature, and takes on the wing a large part of its food. It does not, however, confine itself to this method of hunting, but picks up some insects from trees and weeds, and even descends to the ground in search of myriapods or thousand legs. The chief complaint against the species is that it preys largely upon honeybees; and this charge is made by both professional bee keepers and others. One bee raiser in Iowa, suspecting the kingbirds of feeding upon his bees, shot a number near his hives; but when the stomachs of the birds were examined by an expert entomologist, not a trace of honeybees could be found.

An examination of 420 stomachs collected in various parts of the

country was made by the Biological Survey, but only 14 were found to contain remains of honeybees. In these 14 stomachs there were in all 50 honeybees, of which 40 were drones, 4 were certainly workers, and the remaining 6 were too badly broken to be identified as to sex.

The insects that constitute the great bulk of the food of the bird are noxious species, largely beetles—May beetles, click beetles (the larvæ of which are known as wire worms), weevils, which prey upon fruit and grain, and a host of others. Wasps, wild bees, and ants are conspicuous elements of the food, far outnumbering the hive bees. During summer many grasshoppers and crickets, as well as leaf hoppers and other bugs, are also eaten. Among the flies in the stomachs examined were a number of robber flies—insects which prey largely upon other insects, especially honeybees, and which are known to commit in this way extensive depredations. It is thus evident that the kingbird by destroying these flies actually does good work for the apiarist. The nineteen robber flies found in the stomachs may be considered more than an equivalent for the four worker honeybees already mentioned. A few caterpillars are eaten, mostly belonging to the group commonly known as cutworms, all the species of which are harmful. About 10 per cent of the food consists of small native fruits, comprising some twenty common species of the roadsides and thickets, such as dogwood berries, elderberries, and wild grapes. The bird is not reported as eating cultivated fruit to an injurious extent, and it is very doubtful if this is ever the case.

FIG. 6.—Kingbird.

Three points seem to be clearly established in regard to the food of the kingbird—(1) that about 90 per cent consists of insects, mostly injurious species; (2) that the alleged habit of preying upon honeybees is much less prevalent than has been supposed, and probably does not result in any great damage; and (3) that the vegetable food consists almost entirely of wild fruits which have no economic value.

THE ARKANSAS KINGBIRD (Tyrannus verticalis).

The Arkansas kingbird of the western United States is not so domestic in its habits as its eastern relative, preferring to live among the scattering oaks on the lonely hillside, rather than in the orchard

about the ranch buildings. The work it does, however, in the destruction of noxious insects fully equals that of any member of its family. Like other flycatchers, it subsists mostly upon insects taken in mid-air, though it eats quite a number of grasshoppers that are probably taken from the ground. The bulk of its food consists of beetles, bugs (Hemiptera), wasps, and wild bees. Like its eastern representative, it has been accused of feeding to an injurious extent upon the honeybee. In an examination of 62 stomachs of this bird, great care was taken to identify every insect or fragment that had any resemblance to a honeybee; as a result, 30 honeybees (*Apis mellifica*) were identified, of which 29 were males or drones and 1 was a worker. These were contained in four stomachs, and were the sole contents of three; in the fourth they constituted 99 per cent of the food. It is evident that the bee-eating habit is only occasional and accidental, rather than habitual; and it is also evident that if this ratio of drones to workers were maintained, the bird would be of more benefit than harm to the apiary.

The Cassin kingbird (*T. vociferans*) has a more southerly range than the Arkansas flycatcher. Examination of a number of stomachs shows that its food habits are similar to those of the others of the group. In their food habits, all of the kingbirds are of the greatest importance to the farmer and fruit grower, as they destroy vast numbers of harmful insects, and do no appreciable damage to any product of cultivation.

THE PHŒBE (Sayornis phœbe).

Among the early spring arrivals at the North, none are more welcome than the phœbe (fig. 7). Though naturally building its nest under an overhanging cliff of rock or earth, or in the mouth of a cave, its preference for the vicinity of farm buildings is so marked that in the more thickly settled parts of the country the bird is seldom seen at any great distance from a farmhouse, except where a bridge spanning a stream affords a secure spot for a nest. Its confiding disposition renders it a great favorite, and consequently it is seldom disturbed. It breeds throughout the United States east of the Great Plains, and winters from the South Atlantic and Gulf States southward.

The phœbe subsists almost exclusively upon insects, most of which are caught upon the wing. An examination of 156 stomachs showed that over 93 per cent of the year's food consists of insects and spiders, while wild fruit constitutes the remainder. The insects belong chiefly to noxious species, and include many click beetles, May beetles, and weevils. In their season grasshoppers are eaten to a considerable extent, while wasps of various species, many flies of species that annoy cattle, and a few bugs and spiders are also eaten regularly. It is evident that a pair of phœbes must materially reduce the number of insects

near a garden or field, as the birds often, if not always, raise two broods a year, and each brood numbers from four to six young.

There is hardly a more useful species about the farm than the phœbe, and it should receive every encouragement. To furnish nesting boxes is unnecessary, as it usually prefers a more open situation, like a shed, or a nook under the eaves, but it should be protected from cats and other marauders.

THE BLACK PHŒBE (Sayornis nigricans semiatra).

The black phœbe is found from Texas west to the Pacific coast, which it occupies as far north as Washington, replacing through most of this region the common or eastern form. It has the same habits as the eastern phœbe, both as to its food and its selection of a nesting site, preferring for this purpose some structure of man, as a shed, or, better still, a bridge over a stream of water. The preference of the black phœbe for the vicinity of water is very pronounced. The observer will always find one at a stream or pool and often at a watering trough by the roadside. A careful study of the habits of the bird shows that it obtains a large portion of its food about wet places. While camping beside a stream in California the writer took some pains to observe the habits of the black phœbes. The nesting season was over and the birds had nothing to do but eat. This they appeared to be doing all the time. When first observed in the morning, at the first glimmer of daylight, a phœbe was always found flitting from rock to rock, although it was so dusky that the bird could hardly be seen. This activity was kept up all day. Even after supper was eaten and it was so dark that notes were written by the aid of the camp fire, the phœbe was still engaged at his work of insect collecting, though it was difficult to understand how it could catch insects when there was scarcely light enough to see the bird. It may not have been the same bird that worked from dawn to dusk, but there was some individual of the species always busy; and an exploration of the stream up and down showed that every portion of it was patrolled by a phœbe, and that each one apparently did not range over more than 12 or 13 rods of water, and that some times two or three would be seen near together.

FIG. 7.—Phœbe.

This kind of observation alone is sufficient to convince any reasonable person that the number of insects destroyed in a year by the black phœbe is enormous. Fortunately, the examination of stomachs has supplemented observation in the field. Of the 119 stomachs examined, every one contained insects as the great bulk of the food. Only 15 contained any vegetable food at all, and in no case was it a considerable part of the contents of the stomach. The insects eaten were mostly wasps, bugs, and flies (Hymenoptera, Hemiptera, and Diptera), but many beetles were also destroyed. Grasshoppers did not appear, but a few traces of crickets were found. Dragon flies also were eaten. This last item illustrates the fondness of the species for the neighborhood of water. The vegetable matter eaten consisted chiefly of small wild fruits of no economic importance.

THE BLUE JAY (Cyanocitta cristata).

The blue jay (fig. 8) is a common bird of the United States east of the Great Plains. Throughout the year it remains in most of its

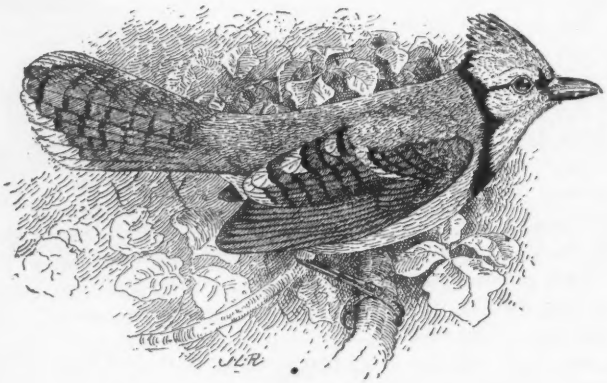

FIG. 8.—Blue jay.

range, though in the Northern States its numbers are somewhat reduced in winter. During spring and summer the jay is forced to become an industrious hunter for insects, and is not so conspicuous a feature of the landscape as when it roams the country at will after the cares of the nesting season are over. Ornithologists and field observers in general declare that a considerable part of its food in spring and early summer consists of the eggs and young of small birds, and some farmers accuse it of stealing corn to an injurious extent in the fall. While doubtless there is much truth in these accusations, they have almost certainly been exaggerated.

In an investigation of the food of the blue jay 300 stomachs were examined, which showed that animal matter comprised 24 per cent and

vegetable matter 76 per cent of the bird's diet. Special search was made for traces of birds or birds' eggs in the stomachs, with the result that shells of small birds' eggs were found in three and the remains of young birds in two. Such negative evidence is not sufficient to controvert the great mass of testimony upon this point, although it shows that the habit is not so widespread as believed. Besides birds and their eggs, the jay eats mice, fish, salamanders, snails, and crustaceans, which altogether constitute but little more than 1 per cent of its diet. The insect food is made up of beetles, grasshoppers, caterpillars, and a few species of other orders, all noxious, except some 3½ per cent of predaceous beetles. Thus something more than 19 per cent of the whole food consists of harmful insects. In August the jay, like many other birds, turns its attention to grasshoppers, which constitute during that month nearly one-fifth of its food. At this time, also, most of the other noxious insects, including caterpillars, are consumed, though beetles are eaten chiefly in spring.

The vegetable food is quite varied, but the item of most interest is grain. Corn was found in 70 stomachs, wheat in 8, and oats in 2—all constituting 19 per cent of the total food. Corn is evidently the favorite grain, but a closer inspection of the record shows that the greater part was eaten during the first five months of the year, and that very little was taken after May, even in harvest time, when it is abundant. This indicates that most of the corn is gleaned from the fields after harvest, except what is stolen from cribs or gathered in May at planting time.

The jay's favorite food is mast (i. e., acorns, chestnuts, chinquapins, etc.), which was found in 200 of the 300 stomachs, and amounted to more than 42 per cent of the whole food. In September corn formed 15 and mast 35 per cent, while in October, November, and December corn dropped to an almost inappreciable quantity and mast amounted to 64, 82, and 83 per cent in the three months, respectively. And yet in these months corn is abundant and everywhere easily accessible. The other elements of food consist of a few seeds and wild fruits, among which grapes and blackberries predominate.

THE PACIFIC COAST JAYS (Aphelocoma californica and Cyanocitta stelleri).

In California and adjacent States two species of jays are much in evidence under several more or less well-marked forms. Steller's jay most resembles the eastern bird, but it is more shy and retiring, and seldom visits the orchard or vicinity of the ranch buildings. Stomach examination shows that its food does not differ radically from that of its eastern congener. As is the case with that bird, a very considerable part of the food consists of mast, together with a little fruit and some insects. The insects are largely wasps and also some beetles and grasshoppers. Besides mast, the jay eats some grain, which is

probably waste or volunteer. So far as the writer knows, no complaints are made against this bird. Until it shall become less wary, it is not likely to trespass to a serious extent upon the farmer's preserve.

The California jay, although of a different genus, more nearly resembles its eastern relative in its food habits and actions. It freely visits the stock yards near the ranch buildings, and the orchards and gardens. As a fruit stealer it is notorious. On one occasion the writer shot seven jays from a prune tree, one after the other, leaving the dead bodies under the tree until all were killed. So eager were they to get the fruit that the report of the gun and the sight of their dead did not deter them from coming to the tree even before the fallen ones could be picked up. In orchards in canyons or on the hillsides adjacent to chaparral or other cover, great mischief is done by this bird. In one case, an orchard, situated on a piece of flat bottom land in a canyon just at the point where a small side canyon or ravine opened in, was under observation at a time when the prune crop was ripening. Jays in a continuous stream were seen to come down the small ravine to the orchard, prey upon the fruit, and return, in many cases each carrying off a prune.

Fruit stealing, however, is only one of the sins of the California jay. That it robs hens' nests of their eggs is the universal testimony. A woman who lived at the mouth of a small ravine told me that one of her hens had a nest under a clump of bushes. Every day a jay came to a tree a few rods away. When it heard the cackle of the hen announcing a new egg, it flew at once to the nest. At the same time the mistress of the house hastened to the spot to secure the prize, but in most cases the jay won the race and got the egg. This is only one of many similar cases recounted. The jays have learned just what the cackle of the hen means. Another case more serious is that related by a young man engaged in raising white leghorn fowls on a ranch several miles up a canyon. He says that when the chicks were very young the jays would attack and kill them by a few blows of the beak and then peck open the skull and eat out the brains. In spite of all the efforts to protect the chicks and kill the jays, the losses in this way were serious.

The examination of the stomachs of 141 California jays shows that 35 per cent of the contents for the year consists of animal matter and 65 per cent of vegetable. Although the great bulk of the animal food consists of insects, the remains of eggshells and birds' bones appear much too often. The insect food is fairly well distributed among the more common orders, but grasshoppers are slightly the most numerous and constitute 5 per cent of the year's food. In July, August, and September, however, the amount is 14, 18, and 19 per cent, respectively. Four per cent of the food consists of wasps, bees, etc., but in the three months named they constitute 15, 7, and 9 per

cent, respectively. A worker honeybee was found in each of two stomachs. It is rather surprising to find a bird like the jay eating so many of these active and elusive insects. One expects to find such insects in the diet of a flycatcher, but hardly in that of a jay. The remainder of the insect food is pretty evenly distributed among beetles, bugs, flies, and caterpillars. Eggshells were found in 21 stomachs and birds' bones in 5. Six stomachs contained the bones of mammals and 2 those of a lizard. No bird has a worse reputation for nest robbing than the eastern jay, and yet out of 300 stomachs of this species only 3 contained eggshells and 2 the bones of birds. This comparison serves to show what a marauder and nest thief the California jay really is.

In its vegetable diet this bird much resembles its eastern relative, the most remarkable difference being in the matter of fruit eating. With greater opportunities, the California bird has developed a greater appetite for fine fruit, and indulges it to the fullest extent. Remains of fruit were found in 114 of the 141 stomachs. The percent for the year is only 16, but for the four months of June, July, August, and September it is 44, 33, 53, and 25, respectively. Cherries, apricots, and prunes are the favorites among the cultivated fruits. Elderberries are eaten to some extent. Grain, which was found in 48 stomachs, amounts to 6 per cent of the food of the year. Practically all of it was taken in the four months above mentioned, but it is not probable that much damage is done by the jay in this respect. The major part of the grain was oats. What was not the wild variety was probably simply scattered grain gleaned after the harvest. Mast is eaten by the California jay from September to March inclusive, and constitutes during most of that period one of the principal elements of its food. In this respect the bird shows a remarkable similarity to the eastern jay. A few weed seeds and other miscellaneous items make up the balance of the vegetable food.

In summing up from an economic point of view the character of the food of the California jay, it must be conceded that it is not all that could be wished. It is evident that the taste of the jay for birds' eggs and fine fruit is entirely too pronounced. That the bird will ever reform in the first respect is not to be hoped; in the case of the fruit stealing, it is probable that while it would not cease with a reduction of the bird's numbers, it would be so lessened as not to be noticeable. At the present time the species is superabundant in California. While the natural food supply of the bird has been lessened by bringing the woods and brushy canyons under cultivation, the same areas have been planted to fruit, and it is perfectly natural that this should be held by the jay as a legitimate source of food supply.

THE CROW (Corvus americanus).

There are few birds so well known as the common crow. Unlike most other species, he does not seem to decrease in numbers as the country becomes more densely populated. The crow is commonly regarded as a blackleg and a thief. Without the dash and brilliancy of the jay, or the bold savagery of the hawk, he is accused of doing more mischief than either. That he does pull up sprouting corn, destroy chickens, and rob the nests of small birds has been repeatedly proved. Nor are these all of his sins. He is known to eat frogs, toads, salamanders, and some small snakes, all harmless creatures that do some good by eating insects. With so many charges against him, it may be well to show why he should not be utterly condemned.

The examination of a large number of stomachs shows that the bird's-nesting habit, as in the case of the jay, is not so universal as has been supposed. Neither are many toads and frogs eaten. As frogs are of no great practical value, their destruction is not a serious matter; but toads are very useful, and their consumption, so far as it goes, must be counted against the crow. Turtles, crayfishes, and snails, of which he eats quite a large number, may be considered neutral, while mice may be counted to his credit.

In his insect food, however, the crow makes amends for sins in the rest of his dietary, although even here the first item is against him. Predaceous beetles are eaten in some numbers throughout the season, but the number is not great. May beetles, "dor-bugs," or June bugs, and others of the same family constitute the principal food during spring and early summer, and are fed to the young in immense quantities. Other beetles, nearly all of a noxious character, are eaten to a considerable extent. Grasshoppers are first taken in May, but not in large numbers until August, when, as might be expected, they form the leading article of diet. This shows that the crow is no exception to the general rule that most birds subsist, to a large extent, upon grasshoppers in the month of August. Many bugs, some caterpillars, mostly cutworms, and some spiders are also eaten—all of them either harmful or neutral. Of the insect diet, Mr. E. A. Schwarz says: "The facts, on the whole, speak overwhelmingly in favor of the crow."

Probably the most important item in the vegetable food of the crow is corn. By pulling up the newly sprouted seeds, the bird renders himself extremely obnoxious. Observation and experiments with tame crows show that hard, dry corn is never eaten if anything else is to be had, and that if fed to nestlings it is soon disgorged. The reason crows resort to newly planted fields is that the kernels of corn are softened by the moisture of the earth, and probably become more palatable in the process of germination, which changes the starch of the grain to sugar. Crows eat corn extensively only when it has been softened by germination or partial decay, or before it is ripe and still

"in the milk." Experience has shown that they may be prevented from pulling up young corn by tarring the seed, which not only saves the corn but forces them to turn their attention to insects. If they persist in eating green corn it is not so easy to prevent the damage; but no details of extensive injury in this way have yet been presented, and it is probable that no great harm has been done.

Crows eat fruit to some extent, but confine themselves for the most part to wild species, such as dogwood, sour gum, and seeds of the different kinds of sumac. They have also a habit of sampling almost everything which appears eatable, especially when food is scarce.

FIG. 9.—Bobolink.

In estimating the economic status of the crow, the bird should receive much credit for the insects which it destroys. In the more thickly settled parts of the country it probably does more good than harm, at least when ordinary precautions are taken to protect young poultry and newly planted corn against its depredations.

THE BOBOLINK, OR RICEBIRD (Dolichonyx oryzivorus).

The bobolink (fig. 9) is a common summer resident of the United States, north of about latitude 40°, and from New England westward to the Great Plains, wintering beyond our southern border. In New England there are few birds, if any, around which so much romance clusters; in the South none on whose head so many maledictions are

heaped. The bobolink, entering the United States from the South at a time when the rice fields are freshly sown, pulls up the young plants and feeds upon the seed. Its stay, however, is not long, and it soon hastens to the North, where it is welcomed as a herald of summer. During its sojourn in the Northern States it feeds mainly upon insects and small seeds of useless plants; but while rearing its young, insects constitute its chief food, and almost the exclusive diet of its brood. After the young are able to fly, the whole family gathers into a small flock and begins to live almost entirely upon vegetable food. This consists for the most part of weed seeds, since in the North these birds do not appear to attack grain to any great extent. They eat a few oats, but their stomachs do not reveal a great quantity of this or any other grain. As the season advances they gather into larger flocks and move southward, until by the end of August nearly all have left their breeding grounds. On their way they frequent the reedy marshes about the mouths of rivers and on the inland waters of the coast region, and subsist largely upon wild rice. After leaving the Northern States they are commonly known as reed birds, and becoming very fat are treated as game.

In the latter part of August the bobolinks begin to arrive on the rice fields, and during the next month make havoc in the ripening crop. It is unfortunate that the rice districts lie exactly in the track of their fall migration, since the abundant supply of food thus offered has undoubtedly served to attract them more and more, until most of the Northern-bred birds are concentrated with disastrous effect on the southeast coast when the rice ripens in the fall. The annual loss to rice growers on account of bobolinks has been estimated at $2,000,000.

THE REDWINGED BLACKBIRD (Agelaius phœniceus).

The redwinged or swamp blackbird (fig. 10) is found all over the United States and the region immediately to the north. While common in most of its range, its distribution is more or less local, mainly on account of its partiality for swamps. Its nest is built near standing water, in tall grass, rushes, or bushes. Owing to this peculiarity the bird may be absent from large tracts of country which afford no swamps or marshes suitable for nesting. It usually breeds in large colonies, though single families, consisting of a male with several wives, may be found sometimes in a small slough, where each of the females builds her nest and rears her own little brood, while her liege lord displays his brilliant colors and struts in the sunshine. In the upper Mississippi Valley the species finds the conditions most favorable, for the countless prairie sloughs and the margins of the numerous shallow lakes afford nesting sites for thousands of redwings; and there are bred the immense flocks which sometimes do so much damage to the grain

fields of the West. After the breeding season, the birds collect in flocks to migrate, and remain thus associated throughout the winter.

Many complaints have been made against the redwing, and several States have placed at times a bounty upon its head. It is said to cause great damage to grain in the West, especially in the upper Mississippi Valley; and the rice growers of the South say that it eats rice. No complaints come from the northeastern part of the country, where the bird is much less abundant than in the West and South.

The examination of 1,083 stomachs showed that vegetable matter forms 74 per cent of the food, while the animal matter, mainly insects, forms but 26 per cent. A little more than 10 per cent consists of beetles, mostly harmful species. Weevils, or snout beetles, amount to 4 per cent of the year's food, but in June reach 25 per cent. As weevils are among the most harmful insects known, their destruction should condone for at least some of the sins of which the bird is accused. Grasshoppers constitute nearly 5 per cent of the food, while the rest of the animal matter is made up of various insects, a few snails, and crustaceans. The few dragon flies found were probably picked up dead, for they are too active to be taken alive, unless by a flycatcher. So far as the insect food as a whole is concerned, the redwing may be considered entirely beneficial.

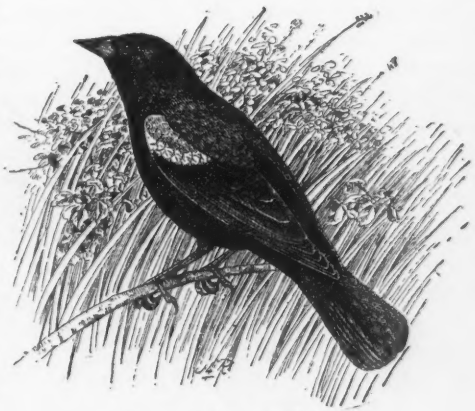

FIG. 10.—Redwinged blackbird.

The interest in the vegetable food of this bird centers around the grain. Only three kinds, corn, wheat, and oats, were found in appreciable quantities in the stomachs. They aggregate but little more than 13 per cent of the whole food, oats forming nearly half of this amount. In view of the many complaints that the redwing eats grain, this record is surprisingly small. The crow blackbird has been found to eat more than three times as much. In the case of the crow, corn forms one-fifth of the food, so that the redwinged blackbird, whose diet is made up of only a trifle more than one-eighth of grain, is really one of the least destructive species. The most important item of the bird's food, however, is weed seed, which forms practically the whole food in winter and about 57 per cent of the fare of the whole year. The principal weed seeds eaten are those of ragweed, barn grass, and

smartweed. That these seeds are preferred is shown by the fact that the birds begin to eat them in August, when grain is still readily accessible, and continue feeding on them even after insects become plentiful in April. The redwing eats very little fruit and does practically no harm in the garden or orchard. Nearly seven-eighths of its food is made up of weed seed or of insects injurious to agriculture, indicating unmistakably that the bird should be protected, except, perhaps, in a few places where it is over abundant.

THE MEADOWLARK (Sturnella magna).

The meadowlark (fig. 11) is a common and well-known bird occurring from the Atlantic coast to the Great Plains, where it gives way to a

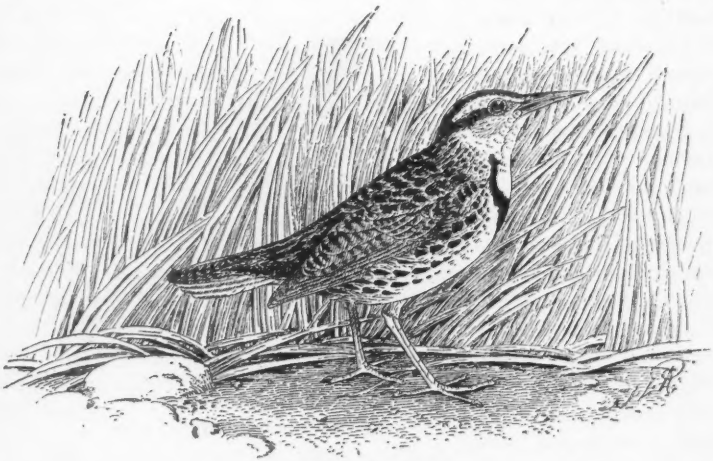

FIG. 11.—Meadowlark.

closely related subspecies, which extends thence westward to the Pacific. It winters from our southern border as far north as the District of Columbia, southern Illinois, and occasionally Iowa. Although it is a bird of the plains, and finds its most congenial haunts in the prairies of the West, it does not disdain the meadows and mowing lands of New England. It nests on the ground.

In the 285 stomachs examined, animal food (practically all insects) constituted 73 per cent of the contents, and vegetable matter 27 per cent. As would naturally be supposed, the insects were ground species, such as beetles, bugs, grasshoppers, and caterpillars, together with a few flies, wasps, and spiders. A number of the stomachs were taken from birds killed when the ground was covered with snow, but even these contained a large percentage of insects, showing the bird's skill in finding proper food under adverse circumstances.

Of the various insects eaten, crickets and grasshoppers are the most important, constituting 29 per cent of the food of the year and 69 per cent of the food in August. It is scarcely necessary to enlarge upon this point, but the beneficial effect a number of these birds must have on a field of grass in the height of the grasshopper season can be readily seen. Of the 285 stomachs collected at all seasons of the year, 184, or nearly two-thirds, contained remains of grasshoppers, and one was filled with fragments of 37 of these insects. This seems to show conclusively that grasshoppers are preferred, and are eaten whenever they can be found. The great number taken in August is especially notable. August is essentially the grasshopper month, i. e., the month when grasshoppers reach their maximum abundance, and stomach examination shows that a large number of birds resort at this time to this diet, no matter what may be the food during the rest of the year.

Next to grasshoppers, beetles make up the most important item of the meadowlark's food, amounting to nearly 21 per cent, of which about one-third are predaceous ground beetles. The others are all harmful species. When it is considered that the bird feeds exclusively on the ground, it seems remarkable that so few useful ground beetles are eaten. Many of the useful kinds have a disgusting odor, and possibly this may occasionally save them from destruction by birds, especially when other food is abundant. Caterpillars, too, form a very constant element of the food, and in May constitute over 28 per cent of the whole. May is the month when the dreaded cutworm begins its deadly career, and then the lark does some of its best work. Most of these caterpillars are ground feeders, and are overlooked by birds which habitually frequent trees, but the meadowlark finds and devours them by thousands. The remainder of the insect food is made up of a few ants, wasps, and spiders, with a few bugs, including some chinch bugs.

The vegetable food consists of grain, weed, and other hard seeds. Grain in general amounts to 14 per cent, and weed and other seeds to 12 per cent. Grain, principally corn, is eaten mostly in winter and early spring, and must be, therefore, simply waste kernels; only a trifle is consumed in summer and autumn, when it is most plentiful. No trace of sprouting grain was discovered. Clover seed was found in only six stomachs, and but little in each. Seeds of weeds, principally ragweed, barn grass, and smartweed, are eaten from November to April, inclusive, but during the rest of the year are replaced by insects.

Briefly stated, more than half of the meadow lark's food consists of harmful insects; its vegetable food is composed either of noxious weeds or waste grain, and the remainder is made up of useful beetles or neutral insects and spiders. A strong point in the bird's favor is that, although naturally an insect eater, it is able to subsist on vegetable food, and consequently is not forced to migrate in cold weather farther than is necessary to find ground free from snow.

THE BALTIMORE ORIOLE (Icterus galbula).

Brilliancy of plumage, sweetness of song, and food habits to which no exception can be taken are some of the striking characteristics of the Baltimore oriole (fig. 12). In summer it is found throughout the northern half of the United States east of the Great Plains. Its nest commands hardly less admiration than the beauty of its plumage or the excellence of its song. Hanging from the tip of the outermost bough of a stately elm, it is almost inaccessible, and so strongly fastened as to bid defiance to the elements.

Observation both in the field and laboratory shows that caterpillars constitute the largest item of the fare of the oriole. In 202 stomachs they formed 34 per cent of the food. They are eaten in varying quantities during all the months in which the bird remains in this country. The fewest are eaten in July, when a little fruit is also

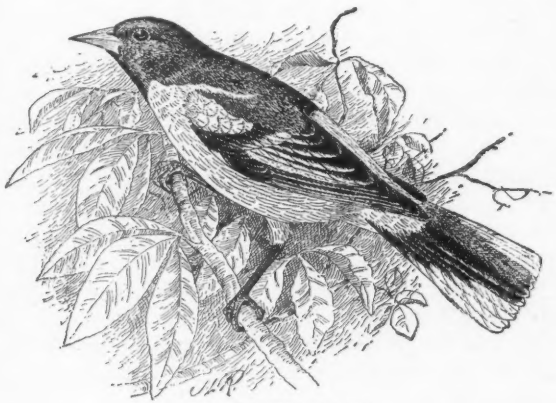

FIG. 12.—Baltimore oriole.

taken. The other insects consist of beetles, bugs, ants, wasps, grasshoppers, and some spiders. The beetles are principally click beetles, the larvæ of which are among the most destructive insects known; and the bugs include plant and bark lice, both very harmful, but so small and obscure as to be passed over unnoticed by most birds. Ants are eaten mostly in spring, grasshoppers in July and August, and wasps and spiders with considerable regularity throughout the season.

During the stay of the oriole in the United States, vegetable matter amounts to only a little more than 16 per cent of the food of the bird, so that the possibility of its doing much damage to crops is very limited. It is accused of eating peas to a considerable extent, but remains of such were found in only two stomachs. One writer says that it damages grapes, but none were found.

THE BULLOCK ORIOLE (Icterus bullocki).

The Bullock oriole is the western representative of the Baltimore oriole, taking the place of that species throughout the Pacific coast region. It does not differ essentially in its habits of nesting or in its food from its eastern relative, but it is less beautiful in plumage. The examination of 70 stomachs shows that 75 per cent of its food consists of insects, mostly of a noxious character. Caterpillars constitute 26 per cent of the food, the rest being made up of wasps, grasshoppers, bugs (Hemiptera), and a few beetles. Among the Hemiptera, perhaps the most interesting is the black olive scale (*Lecanium oleæ*), which was found in 17 stomachs and constituted nearly 7 per cent of the whole food. It is not surprising that these small creatures are eaten by small birds like the titmice, but they must have some very agreeable properties as food in order to attract birds like the oriole. The vegetable contingent of the oriole's food is mostly fruit, especially in June and July, when it takes kindly to cherries and apricots, and sometimes eats more than the fruit grower considers a fair share. However, no great complaint is made against the bird, and it is probable that as a rule it does not do any serious harm. With such a good record as an insect eater one can well afford to spare it a few cherries.

THE CROW BLACKBIRD OR GRACKLE (Quiscalus quiscula).

The crow blackbird (fig. 13) in one or more of its subspecies is a familiar object in all the States east of the Rocky Mountains. Throughout the year it is resident as far north as southern Illinois, and in summer extends its range into the British provinces. In the Mississippi Valley it is one of the most abundant birds, preferring to nest in the artificial groves and windbreaks near farms instead of in the natural "timber" which it formerly used. It breeds also in parks and near buildings, often in considerable colonies. Farther east, in New England, it is only locally abundant, though frequently seen in migration. After July it becomes very rare, or entirely disappears, owing to the fact that it collects in large flocks and retires to some quiet place where food is abundant and where it can remain undisturbed during the molting season; but in the latter days of August and throughout September it usually reappears in immense numbers before moving southward.

The crow blackbird is accused of many sins, such as stealing grain and fruit and robbing the nests of other birds; but the farmers do not undertake a war of extermination against it, and for the most part allow it to nest undisturbed about their premises. An examination of 2,346 stomachs shows that nearly one-third of its food consists of insects, of which the greater part are injurious. The bird also eats

a few snails, crayfishes, salamanders, small fish, and occasionally a mouse. The stomach contents do not indicate that it robs other birds' nests to any great extent, as remains of birds and birds' eggs amount to less than half of 1 per cent.

It is on account of its vegetable food that the grackle is most likely to be accused of doing damage. Grain is eaten during the whole year, and during only a short time in summer is other food attractive enough to induce the bird to alter its diet. The grain taken in the winter and spring months probably consists of waste kernels gathered from the stubble. The stomachs do not indicate that the bird pulls sprouting grain; but the wheat eaten in July and August and the corn eaten in the fall are probably taken from fields of standing

FIG. 13.—Crow blackbird.

grain. The total grain consumed during the year constitutes 45 per cent of the whole food, but it is safe to say that at least half is waste grain, and consequently of no value. Although the crow blackbird eats in their season a few cherries and blackberries, and in the fall some wild fruit, it apparently does no damage in this way.

Large flocks of crow blackbirds no doubt do considerable injury to grain crops; and there seems to be no remedy except the destruction of the birds, which is in itself expensive. During the breeding season, however, the species does much good by eating insects and by feeding them to its young, which are reared almost entirely upon this food. The bird does the greatest amount of good in spring, when it follows the plow in search of large grub-worms, of which it is so fond that it sometimes literally crams its stomach full of them.

THE SPARROWS.[a]

Sparrows are not obtrusive birds, either in plumage, song, or action. There are some forty species, with nearly as many subspecies, in North America. Not more than half a dozen forms are generally known in any one locality. All the species are more or less migratory, but so widely are they distributed that there is probably no part of the country where some can not be found throughout the year.

While sparrows are noted seed eaters, they do not by any means confine themselves to a vegetable diet. During the summer, and especially in the breeding season, they eat many insects, and feed their young largely upon the same food. An examination of the stomachs of three species—the song sparrow (*Melospiza*), chipping sparrow (*Spizella socialis*), and field sparrow (*Spizella pusilla*—fig. 14)—shows that about one-third of the food consists of insects, comprising many injurious beetles, such as snout-beetles or weevils, and leaf-beetles. Many grasshoppers are eaten. In the case of the chipping sparrow, these insects form one-eighth of the food. Grasshoppers would seem to be rather large morsels, but the bird probably confines itself to the smaller species; indeed, this is indicated by the fact that the greatest amount (over 36 per cent) is eaten in June, when the larger species are still young and the smaller most numerous. Besides the insects already mentioned, many wasps and bugs are taken. Predaceous and parasitic Hymenoptera and predaceous beetles, all useful insects, are eaten only to a slight extent, so that as a whole the insect diet of the sparrows may be considered beneficial.

FIG. 14.—Field sparrow.

[a] The sparrows here mentioned are all native species. For a full account of the English sparrow, including its introduction, habits, and depredations, see Bul. No. 1 of the Division of Ornithology, published in 1889.

Their vegetable food is limited almost exclusively to hard seeds. This might seem to indicate that the birds feed to some extent upon grain, but the stomachs examined show only one kind—oats—and but little of that. The great bulk of the food is made up of grass and weed seed, which form almost the entire diet during winter. The amount of these consumed is immense.

Anyone acquainted with the agricultural region of the Upper Mississippi Valley can not have failed to notice the enormous growth of weeds in every waste spot where the original sward has been disturbed. By the roadside, on the borders of cultivated fields, or in abandoned fields, wherever they can obtain a foothold, masses of rank weeds spring up and often form impenetrable thickets which afford food and shelter for immense numbers of birds and enable them to withstand great cold and the most terrible blizzards. A person visiting one of these weed patches on a sunny morning in January, when the thermometer is 20° or more below zero, will be struck with the life and animation of the busy little inhabitants. Instead of sitting forlorn and half frozen, they may be seen flitting from branch to branch, twittering and fluttering, and showing every evidence of enjoyment and perfect comfort. If one of them is shot, it will be found in excellent condition—in fact, a veritable ball of fat.

The snowbird (*Junco hyemalis*) and tree sparrow (*Spizella monticola*) are perhaps the most numerous of all the sparrows.

Examination of many stomachs shows that in winter the tree sparrow feeds entirely upon seeds of weeds. Probably each bird consumes about one-fourth of an ounce a day. In an article contributed in 1881 to the New York Tribune the writer estimated the amount of weed seed annually destroyed by these birds in Iowa. Upon the basis of one-fourth of an ounce of seed eaten daily by each bird, and supposing that the birds average ten to each square mile, and that they remain in their winter range two hundred days, we shall have a total of 1,750,000 pounds, or 875 tons, of weed seed consumed in a single season by this one species. Large as these figures may seem, they unquestionably fall far short of the reality. The estimate of ten birds to a square mile is much within the truth, for the tree sparrow is more abundant than this in winter in Massachusetts, where the food supply is less than in the Western States. The writer has known places in Iowa where several thousand tree sparrows could be seen within the space of a few acres. This estimate, moreover, is for a single species, while, as a matter of fact, there are at least half a dozen birds (not all sparrows) that habitually feed during winter on these seeds. Farther south the tree sparrow is replaced in winter by the white-throated sparrow, the white-crowned sparrow, the fox sparrow, the song sparrow, the field sparrow, and several others; so that all over the land a vast number of these seed eaters are at work during the colder months reducing next year's crop of worse than useless plants.

THE HOUSE FINCH (Carpodacus mexicanus frontalis).

Of all the sparrow group, there is probably no member, unless it be the exotic form known as the English sparrow, that has by reason of its food habits called down so may maledictions upon its head as the house finch, red head, or linnet, as it is variously called. This bird, like the other members of its family, is a seed eater by nature, and before the beginning of fruit raising in California probably subsisted upon the seeds of weeds, with an occasional taste of some wild berry. Now, however, when orchards have extended throughout the length and breadth of the State and every month from May to December sees some ripening fruit, the linnets take their share. As their name is legion, the sum total of the fruit that they destroy is more than the fruit raiser feels that he can well spare. As the bird has a stout beak, it has no difficulty in breaking the skin of the hardest fruit and feasting upon the pulp, thereby spoiling the fruit and giving weaker-billed birds a chance to sample and acquire a taste for what they might not otherwise have molested. Complaints against this bird have been many and loud, more especially in the years when fruit crops first became an important factor in the prosperity of the Pacific coast. At that time the various fruits presented to the linnets a new and easily obtained food, while cultivation had reduced their formerly abundant supply of weed seed. When the early fruit growers saw their expected golden harvest suddenly snatched away, or at least much reduced in value by the little marauders, it is no wonder that they were exasperated and wished to destroy utterly the authors of the mischief.

In order to test the matter thoroughly and ascertain whether these birds ate any other kind of food that might to some extent offset the damage that they inflicted upon the fruit, the horticulturists and ornithologists of California were requested to kill a number of the birds and send their stomachs to the Biological Survey. An agent was also sent to the fruit-raising regions, who watched the birds in the orchards and collected a number of them. In this way 987 stomachs were obtained and carefully examined, and the result shows that animal food (insects) constituted 3.7 per cent, and vegetable food 96.3 per cent of the stomach contents, not counting gravel.

So small a proportion of animal food does not of course admit of any great amount of insect destruction. As these stomachs were collected in every month in the year, with the greater number taken during the summer months, it is evident that whatever good one may hope to get from the linnet must not be looked for in this direction. Unlike most of the sparrow family, the linnet does not feed its young upon insects to any great extent. Quite a number of nestlings were dissected and the contents of their stomachs carefully examined. The only animal food that was found consisted of woolly plant lice. These also constituted the great bulk of the animal food eaten by the adults.

The vegetable food of the species consists of three principal items—grain, fruit, and weeds. Grain amounts to less than 1½ per cent in August, which is the month of greatest consumption. The average for the year is a trifle more than one-fourth of 1 per cent. Fruit attains its maximum in September, when it amounts to 23 per cent of the whole food. The average for the year is 9 per cent. The seeds of weeds constitute the bulk of the diet of the linnet. In August, the month of least consumption, they amount to about 69 per cent of the food. The average for the year is 87 per cent.

From the foregoing it is evident that whatever the linnet's sins may be, grain eating is not one of them. In view of the great complaint made against the linnet on the score of fruit eating, the small quantity found in the stomachs taken is somewhat of a surprise. But it must be remembered that the stomach contents do not tell the whole story. When a bird takes a single peck from a cherry or apricot, it spoils the whole fruit, and in this way may ruin half a dozen such in taking a

FIG. 15.—Rose-breasted grosbeak.

single meal. It is safe to say that the fruit pulp found in the stomach does not represent more than one-fifth of what is actually destroyed That the linnets are persistent and voracious eaters of the early fruits, especially cherries and apricots, every fruit raiser in California will bear testimony. That the damage is often serious no one will deny. It is noticed, however, that the earliest varieties are the ones most affected; also, that in large orchards the damage is not noticed, while in small plantations the whole crop is frequently destroyed.

THE ROSE-BREASTED GROSBEAK (Zamelodia ludoviciana).

The beautiful rose-breasted grosbeak (fig. 15) breeds in the northern half of the United States east of the Missouri River, but spends its winters beyond our boundaries. The beauty of the male is proverbial; the fully adult bird is pure black and white, with a broad patch of brilliant rose color upon the breast and under each wing.

When the Colorado potato beetle first swept over the land, and naturalists and farmers were anxious to discover whether or not there were any enemies which would prey upon the pest, the grosbeak was almost the only bird seen to eat the beetles. Further observation confirmed the fact, and there can be no reasonable doubt that where the bird is abundant it has contributed very much to the abatement of the pest which has been noted during the last decade. But this is not the only good which the bird does, for many other noxious insects besides the potato beetle are eaten.

The vegetable food of the grosbeak consists of buds and blossoms of forest trees, and seeds, but the only damage of which it has been accused is the stealing of green peas. The writer has observed it eating peas and has examined the stomachs of several that were killed in the very act. The stomachs contained a few peas and enough potato beetles old and young, as well as other harmful insects, to pay for all the peas the birds would be likely to eat in a whole season. The garden where this took place adjoined a small potato field which earlier in the season was so badly infested with the beetles that the vines were completely riddled. The grosbeaks visited the field every day, and finally brought their fledged young. The young birds stood in a row on the topmost rail of the fence and were fed with the beetles which their parents gathered. When a careful inspection was made a few days later, not a beetle, old or young, could be found; the birds had swept them from the field and saved the potatoes.

THE BLACK-HEADED GROSBEAK (**Zamelodia melanocephala**).

The black-headed grosbeak is found over the whole Pacific coast and Rocky Mountain region, and takes the place filled by the rose-breasted grosbeak in the eastern part of the United States. In its general habits, including its food, it much resembles its eastern relative, though it lacks the latter's brilliant ornamentation on the breast and under the wings. Seventy stomachs of this bird have been examined, showing 74 per cent of animal and 26 of vegetable food. Caterpillars constitute over 18 per cent of the food, a surprisingly large amount for such a stout-billed bird, which seems better adapted for eating nuts than such soft creatures as caterpillars. One interesting point may be noted in this connection. Thirty-five of the stomachs were from birds taken in an orchard infested with the codling moth. It was a question whether the grosbeaks preyed upon this pest in any of its forms. No moths or larvæ were detected, but pupæ were found and fully identified in 12 of the stomachs and amounted to 8 per cent of the food of the 35 birds. It is unfortunate that the codling moth in the adult form flies by night and in the larval form burrows at once into the apple, so that it is protected from birds in both these stages. It pupates, however, in the crevices of the bark of the tree

trunk, or on the ground in loose rubbish or clods of earth. In this latter state the birds find and destroy it.

Another element of the black-headed grosbeak's food that was not looked for in the stomach of so large and stout a bird was the black olive scale. Of the 70 stomachs examined, 40 contained this scale and to such an extent that it amounted to 15 per cent of the food of the entire 70 birds. Beetles, mostly harmful species, were eaten to the extent of 29 per cent. Prominent among these were the long-horned beetles, whose larvæ are largely borers in trees and other plants—a very harmful family of insects. Next in abundance are the click beetles, whose larvæ are commonly known as wireworms. They live in the ground and feed upon the roots and stalks of plants. More abundant, however, than either of the foregoing were the Chrysomelids, the leaf-eating beetles, which made up 23 per cent of the whole food. Some of the greatest insect pests are found in this family, such as the Colorado potato beetle and the striped and spotted squash beetles. This last species is eaten freely by the grosbeak. It was found, with various other members of the family, in 46 of the 70 stomachs. It has been shown that the rose-breasted grosbeak eats the Colorado potato beetle whenever it is obtainable. It is probable that if this insect should ever be introduced into California and the other Pacific States, the black-headed grosbeak would be found ready to do its part in keeping the pest within bounds.

The vegetable food of the bird consists largely of fruit, with an occasional kernel of grain or some other seed. But so far as known, no complaints have been made against the grosbeak on the score of eating fruit, and it is probable that what it does take is more than paid for by the numbers of noxious insects which it destroys.

THE SWALLOWS.

There are seven common species of swallows within the limits of the United States, four of which have abandoned to some extent their primitive nesting habits and have attached themselves to the abodes of man.

In the eastern part of the country the barn swallow (*Hirundo erythrogastra*—fig. 16) now builds exclusively under roofs, having entirely abandoned the rock caves and cliffs in which it formerly nested. More recently the cliff swallow (*Petrochelidon lunifrons*) has found a better nesting site under the eaves of buildings than was afforded by the overhanging cliffs of earth or stone which it once used and to which it still resorts occasionally in the East, and habitually in the unsettled West. The martin (*Progne subis*) and the white-bellied swallow (*Iridoprocne bicolor*) nest either in houses supplied for the purpose, in abandoned nests of woodpeckers, or in natural crannies in rocks.

Field observation will convince an ordinarily attentive person that the food of swallows must consist of the smaller insects captured in mid-air, or perhaps in some cases picked from the tops of tall grass or weeds. This observation is borne out by an examination of stomachs, which shows that the food consists of many small species of beetles which are much on the wing; many species of Diptera (mosquitoes and their allies), together with large quantities of flying ants and a few insects of similar kinds. Most of these are either injurious or annoying, and the numbers destroyed by swallows are not only beyond calculation, but almost beyond imagination.

FIG. 16.—Barn swallow.

Unlike many other groups of birds the six species of swallows found in the Eastern States extend in a practically unchanged form across the continent to the Pacific coast, where they are reinforced by another species, the violet green swallow (*Tachycineta thalassina lepida*).

It is a mistake to tear down from the eaves of a barn the nests of a colony of cliff swallows, for so far from disfiguring a building they make a picturesque addition to it. The presence of swallows should be encouraged by every device. It is said that cliff and barn swallows may be induced to build their nests in a particular locality, otherwise

suitable, by providing a quantity of mud to be used by them as mortar. Barn swallows may also be encouraged by cutting a small hole in the gable of the barn, while martins and white-bellied swallows will be grateful for boxes like those for the bluebird, but placed in some higher situation.

THE CEDARBIRD (Ampelis cedrorum).

The cedar waxwing, or cherry bird (fig. 17), inhabits the whole of the United States, but is much less common in the West. Although the great bulk of the species retires southward in winter, the bird is occasionally found in every State during the colder months, especially if wild berries are abundant. Its proverbial fondness for cherries has given it its popular name, and much complaint is made on account of the fruit it eats. Observation shows, however, that its depredations are confined to trees on which the fruit ripens earliest, while later varieties are comparatively untouched. This is probably due to the fact that when wild fruits ripen they are preferred to cherries, and really constitute the bulk of the diet of the cedarbird.

FIG. 17.—Cedarbird.

In 152 stomachs examined animal matter formed only 13 per cent and vegetable matter 87 per cent, showing that the bird is not wholly a fruit eater. With the exception of a few snails, all the animal food consisted of insects, mainly beetles—all but one more or less noxious, the famous elm leaf beetle being among the number. Bark or scale lice were found in several stomachs, while the rest of the animal food was made up of grasshoppers, bugs, and the like. Three nestlings had been fed almost entirely on insects.

Of the 87 per cent of vegetable food, 74 per cent consisted entirely of wild fruit or seeds and 13 of cultivated fruit, though a large part of the latter was made up of blackberries and raspberries, which may or may not have represented cultivated varieties. Cherry stealing is the chief complaint against this bird, but of the 152 stomachs only 9, all taken in June and July, contained any remains of cultivated cher-

ries, and these aggregated but 5 per cent of the year's food. As 41 stomachs were collected in these months, it is evident that the birds do not live to any great extent on cultivated cherries.

Although the cherry bird is not a great insect destroyer, it does some good work in this way, since it probably rears its young mostly upon insect food. On the other hand, it does not devour nearly as much cultivated fruit as has been asserted. Most, if not all, of the damage can doubtless be prevented by planting near garden or orchard such trees as the Russian mulberry, whose fruit attracts so many birds.

THE CATBIRD (Galeoscoptes carolinensis).

The catbird (fig. 18), like the thrasher, is a lover of swamps, and delights to make its home in a tangle of wild grapevines, greenbriers,

FIG. 18.—Catbird.

and shrubs, where it is safe from attack and can find its favorite food in abundance. It is found throughout the United States west to the Rocky Mountains, and occurs also in Washington, Idaho, and Utah, and extends northward into the British provinces. It winters in the Southern States, Cuba, Mexico, and Central America.

Reports from the Mississippi Valley indicate that the catbird is sometimes a serious annoyance to fruit growers. The reason for such reports may possibly be found in the fact that on the prairies fruit-bearing shrubs, which afford so large a part of this bird's food, are conspicuously absent. With the settlement of this region comes an extensive planting of orchards, vineyards, and small-fruit gardens,

which furnish shelter and nesting sites for the catbird, as well as for other species. There is in consequence a large increase in the numbers of the birds, but no corresponding gain in the supply of native fruits upon which they were accustomed to feed. Under these circumstances, what is more natural than for the birds to turn to cultivated fruits for their food? The remedy is obvious; cultivated fruits can be protected by the simple expedient of planting the wild species which are preferred by the birds. Some experiments with catbirds in captivity show that the Russian mulberry is preferred to any cultivated fruit that can be offered.

The stomachs of 213 catbirds were examined and found to contain 44 per cent of animal (insect) and 56 per cent of vegetable food.[a] Ants, beetles, caterpillars, and grasshoppers constitute three-fourths of the animal food, the remainder being made up of bugs, miscellaneous insects, and spiders. One-third of the vegetable food consists of cultivated fruits, or those which may be cultivated, such as strawberries, raspberries, and blackberries; but while we debit the bird with the whole of this, it is probable—and in the eastern and well-wooded part of the country almost certain—that a large part is obtained from wild vines. The rest of the vegetable matter is mostly wild fruit, such as cherries, dogwood, sour gum, elder berries, green brier, spice berries, black alder, sumac, and poison ivy. Although the catbird sometimes does considerable harm by destroying small fruit, the bird can not be considered injurious. On the contrary, in most parts of the country it does far more good than harm.

THE BROWN THRASHER (Toxostoma rufum).

The brown thrasher (fig. 19) breeds throughout the United States east of the Great Plains, and winters in the South Atlantic and Gulf States. It occasionally visits the garden or orchard, but nests in swamps or in groves standing upon low ground. The thrasher's favorite time for singing is the early morning, when, perched on the top of some tall bush or low tree it gives an exhibition of vocal powers which would do credit to a mocking bird. Indeed, in the South, where the latter bird is abundant, the thrasher is known as the sandy mocker.

The food of the brown thrasher consists of both fruit and insects. An examination of 121 stomachs showed 36 per cent of vegetable and 64 of animal food, practically all insects, mostly taken in spring before fruit was ripe. Half the insects were beetles, and the remainder chiefly grasshoppers, caterpillars, bugs, and spiders. A few predaceous beetles were eaten, but on the whole the work of the species as an insect destroyer may be considered beneficial.

[a] The investigation of the food of the catbird, brown thrasher, and house wren was made by Dr. Sylvester D. Judd and published in the Yearbook of the Department of Agriculture for 1895, pp. 405–408.

Eight per cent of its food is made up of fruits like raspberries and currants which are or may be cultivated, but the raspberries at least are as likely to belong to wild as to cultivated varieties. Grain, made up mostly of scattered kernels of oats and corn, is merely a trifle, amounting to only 3 per cent. Though some of the corn may be taken from newly-planted fields, it is amply paid for by the May beetles which are eaten at the same time by the bird. The rest of the food consists of wild fruit or seeds. Taken all in all, the brown thrasher is a useful bird, and probably does as good work in its secluded retreats as it would about the garden, for the swamps and groves are no doubt the breeding grounds of many insects that migrate thence to attack the crops of the farmer.

FIG. 19.—Brown thrasher.

THE HOUSE WREN (Troglodytes aëdon).

The diminutive house wren (fig. 20) frequents barns and gardens, and particularly old orchards in which the trees are partially decayed. He makes his nest in a hollow branch where perhaps a woodpecker had a domicile the year before, but he is a pugnacious character, and if he happens to fancy one of the boxes that are put up for bluebirds, he does not hesitate to take it. He is usually not slow to avail himself of boxes, gourds, tin cans, or empty jars placed for his accommodation.

As regards food habits, the house wren is entirely beneficial. Practically, he may be said to live upon animal food alone, for an examination of 52 stomachs showed that 98 per cent of the contents was made up of insects or their allies, and only 2 per cent was vegetable food, including bits of grass and similar matter, evidently taken by accident with the insects. Half of this food consisted of grasshoppers and beetles; the remainder of caterpillars, bugs, and spiders. As the

house wren is a prolific breeder, frequently rearing in a season from twelve to sixteen young, a family of these birds must cause considerable reduction in the number of insects in a garden. Wrens are industrious foragers, searching every tree, shrub, or vine for caterpillars, examining every post and rail of the fence, and every cranny in the wall for insects or spiders.

THE TITMICE.

The birds of the titmouse family, though insignificant in size, are far from being so in the matter of their food habits. What they lack in size of body, they more than make up for in numbers of individuals. While in the case of some of the larger birds, as, for

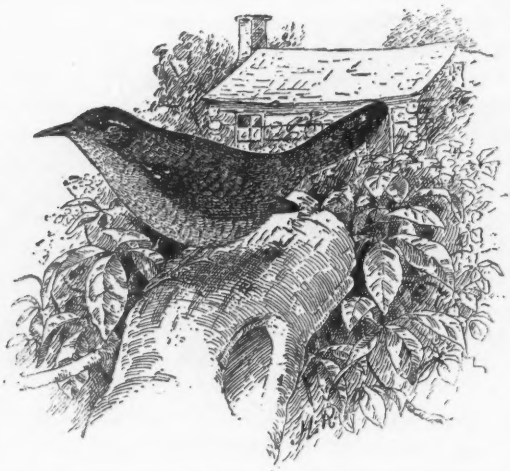

FIG. 20.—House wren.

instance, the flicker, there is one pair of eyes to look for food for one large stomach, we have in the case of the ten times as numerous titmice an equivalent stomach capacity divided by ten, and each portion furnished with a pair of eyes, and other accessories, such as wings and feet. As against the one place occupied by the larger bird, ten are being searched for food at the same time by the smaller species. It is evident that this arrangement is more effective in insect destruction than the plan of a single large bird.

The character of the food of the titmice gives a peculiar value to their services, for it consists largely of the smaller insects and their eggs, objects that either escape the search of the larger birds or are too insignificant to be considered worthy of notice. Throughout the year most of the species of this group remain on their range, so that they are constantly engaged in their beneficial work, continuing it in

winter when the majority of their coworkers have fled to a milder clime. It is at this season that the titmice do their greatest good, for when flying and crawling insects are no more to be found, the birds must feed upon such hibernating species as they find concealed in crevices or upon the eggs of insects laid in similar places. Little reflection is necessary to convince one that in the winter dearth of moving insects, the search for such available food as may be found must be thorough and unremitting.

There are within the boundaries of the United States some 17 species of titmice, with nearly as many races or subspecies, so that there is no portion of the country that does not have one or more forms. The western coast region is peculiarly rich in representatives of this family. In the eastern portion of the country the best-known and most widely distributed species is the common black-capped chickadee (*Parus atricapillus*). This bird, or some of its subspecies, occupies the whole of that part of the United States north of the latitude of Washington, and extends into Canada. It is a prolific breeder, usually rearing from 6 to 8 young in a brood.

The examination of 289 stomachs of the chickadee shows that its food consists of 68 per cent of animal matter (insects), and 32 per cent of vegetable matter. The former is made up of small caterpillars, and moths and their eggs. Prominent among the latter are the eggs of the tent-caterpillar moths, both the orchard and forest species (*Clisiocampa americana* and *C. disstria*). As these are two of our most destructive insects, the good done by the chickadee in devouring their eggs needs no comment. During the winter months, the chickadee's food is made up of larvæ, chrysalids, and eggs of moths, varied by a few seeds, but as spring brings out hordes of flying, crawling, and jumping insects, the bird varies its diet by taking also some of these. Flies and bugs (*Diptera* and *Hemiptera*) are the favorites until the weather becomes quite warm, when beetles and small wasps are also taken. Among the bugs may be mentioned the plant lice and their eggs which are eaten in winter. The beetles nearly all belong to the group of Rhyncophora, or snout beetles, more commonly known as weevils. These insects are mostly of small size, and nearly all of them are known as pests by the farmer or fruit raiser. Seventeen of them were found in one stomach. The plum curculio and the cotton boll weevil may be taken as fair samples. Grasshoppers do not at any time constitute an important element of the food of the chickadee as they are evidently too large for so small a bird; moreover they are for the most part terrestrial insects, while the bird is essentially arboreal. Small wasps and ants are eaten to some extent. Spiders constitute quite an important element of the food and are eaten at all times of the year. The birds evidently find them hibernating in winter as well as active in summer. The vegetable food of the chickadee consists largely of

small seeds, except in summer when they are replaced by pulp of wild fruit. The wax from the seeds of poison ivy (*Rhus radicans*) is eaten during the winter months, but the seeds themselves are not taken. In this respect the chickadees differ from most other birds which swallow the seeds whole, and after digesting the wax, pass them through the alimentary canal, and so scatter them broadcast to reproduce the noxious plants.

In the southern part of the country, the Carolina chickadee and the tufted tit replace the black-cap, but their food habits are so similar that there is no practical difference in the work done. In the West several other species occur; one of the most interesting of these is the bush tit (*Psaltriparus minimus*) which, with several subspecies, occupigs the whole Pacific Coast region. They are minute, active, social little creatures which, except for a short time during the breeding season, are found in flocks, flitting from tree to tree, busily hunting for insects and their eggs. The contents of 66 stomachs of these birds, which were examined, were found to consist mostly of injurious insects to the extent of 83 per cent. Of these the most important was a small Hemipterous insect (*Nysius angustatus*), which amounted to more than half of the whole stomach contents. These insects are of considerable economic importance, as they frequently infest grapevines and other plants to a harmful extent. Several of the stomachs were almost exclusively filled with these minute creatures, some containing as many as 100 individuals.

Perhaps the most important and interesting insect found was the black olive scale (*Lecanium oleæ*), which occured in 24 stomachs and amounted to a little more than 18 per cent of the food. In addition a number of the stomachs were more or less filled with another scale, which was not further identified. A number of small snout beetles (weevils) were eaten and some small caterpillars; there were also the remains of a spider.

The vegetable food of the species seemed to consist mostly of seeds, but they were so broken up as to defy recognition. A little fruit pulp and a little mast were also found. It is difficult to imagine a group of birds that do more good and ask less for the service than the titmice.

THE ROBIN (Merula migratoria).

The robin (fig. 21) is found throughout the United States east of the Great Plains, and is represented farther west by a slightly different subspecies. It extends far north through Canada, and is found even in Alaska. Although the great bulk of the species leaves the Northern States in winter, a few individuals remain in sheltered swamps, where wild berries furnish abundant food. The food habits of the robin have sometimes caused apprehension to the fruit grower, for it is

fond of cherries and other small fruits, particularly the earlier varieties. For this reason many complaints have been lodged against the bird, and some persons have even gone so far as to condemn it. The robin is, however, far too valuable to be exterminated, and choice fruit can be readily protected from its depredations.

An examination of 500 stomachs shows that over 42 per cent of its food is animal matter, principally insects, while the remainder is made up largely of small fruits or berries. Over 19 per cent consists of beetles, about one-third of which are useful ground beetles, taken mostly in spring and fall, when other insects are scarce. Grasshoppers make up about one-tenth of the whole food, but in August comprise over 30 per cent. Caterpillars form about 6 per cent, while the rest of the animal food, about 7 per cent, is made up of various insects,

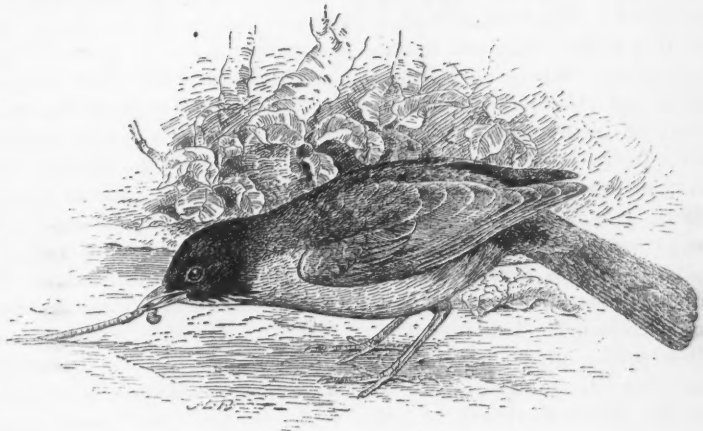

FIG. 21.—Robin.

with a few spiders, snails, and angleworms. All the grasshoppers, caterpillars, and bugs, with a large portion of the beetles, are injurious, and it is safe to say that noxious insects comprise more than one-third of the robin's food.

Vegetable food forms nearly 58 per cent of the stomach contents, over 47 per cent being wild fruits, and only a little more than 4 per cent being possibly cultivated varieties. Cultivated fruit amounting to about 25 per cent was found in the stomachs in June and July, but only a trifle in August. Wild fruit, on the contrary, is eaten in every month, and constitutes during half the year a staple food. No less than 42 species were identified in the stomachs; of these, the most important were 4 species of dogwood, 3 of wild cherries, 3 of wild grapes, 4 of greenbrier, 2 of holly, 2 of elder; and cranberries, huckleberries, blueberries, barberries, service berries, hackberries, and per-

simmons, together with 4 species of sumac, and various other seeds not strictly fruit.

The depredations of the robin seem to be confined to the smaller and earlier fruits, few, if any, complaints being made against it on the score of eating apples, peaches, pears, grapes, or even late cherries. By the time these are ripe the forests and hedges are teeming with wild fruits, which the bird evidently finds more to its taste. The cherry, unfortunately, ripens so early that it is almost the only fruit accessible at a time when the bird's appetite has been sharpened by a long-continued diet of insects, earthworms, and dried berries, and it is no wonder that at first the rich juicy morsels are greedily eaten.

In view of the fact that the robin takes ten times as much wild as cultivated fruit, it seems unwise to destroy the birds to save so little. Nor is this necessary, for by a little care both birds and fruit may be preserved. Where much fruit is grown, it is no great loss to give up one tree to the birds, and in some cases the crop can be protected by scarecrows. Where wild fruit is not abundant, a few fruit-bearing shrubs and vines judiciously planted will serve for ornament and provide food for the birds. The Russian mulberry is a vigorous grower and a profuse bearer, ripening at the same time as the cherry. So far as observation has gone, most birds seem to prefer its fruit to any other. It is believed that a number of mulberry trees planted around the garden or orchard would fully protect the more valuable fruits.

Many persons have written about the delicate discrimination of birds for choice fruit, asserting that only the finest and costliest varieties are selected. This is contrary to all careful scientific observation. Birds, unlike human beings, seem to prefer fruit like the mulberry, that is sweetly insipid, or one that has some astringent or bitter quality like the chokecherry or holly. The so-called black alder (*Ilex verticillata*), which is a species of holly, has bright scarlet berries, as bitter as quinine, that ripen late in October, and remain on the bushes through November. Though frost grapes, the fruit of the Virginia creeper, and several species of dogwood are abundant at the same time, the birds eat the berries of the holly to a considerable extent, as shown by the seeds found in the stomachs. It is, moreover, a remarkable fact that the wild fruits, upon which the birds feed largely, are those which man neither gathers for his own use nor adopts for cultivation.

THE BLUEBIRD (Sialia sialis).

The common and familiar bluebird (fig. 22) is an inhabitant of all the States east of the Rocky Mountains from the Gulf of Mexico northward into Canada. It winters as far north as southern Illinois in the Mississippi Valley and Pennsylvania in the east; in spring it is one of the first migrants to arrive in the Northern States, and is always welcomed as an indication of the final breaking up of winter. It fre-

quents orchards and gardens, where it builds its nest in hollow trees, or takes advantage of a nesting box provided by the farmer's boy.

So far as known, the bluebird has not been accused of stealing fruit or of preying upon crops. An examination of 300 stomachs showed that 76 per cent of the food consists of insects and their allies, while the other 24 per cent is made up of various vegetable substances, found mostly in stomachs taken in winter. Beetles constitute 28 per cent of the whole food, grasshoppers 22, caterpillars 11, and various insects, including quite a number of spiders, comprise the remainder of the animal diet. All these are more or less harmful, except a few predaceous beetles, which amount to 8 per cent. In view of the large consumption of grasshoppers and caterpillars, we can at least condone this offense, if such it may be called. The destruction of grasshoppers

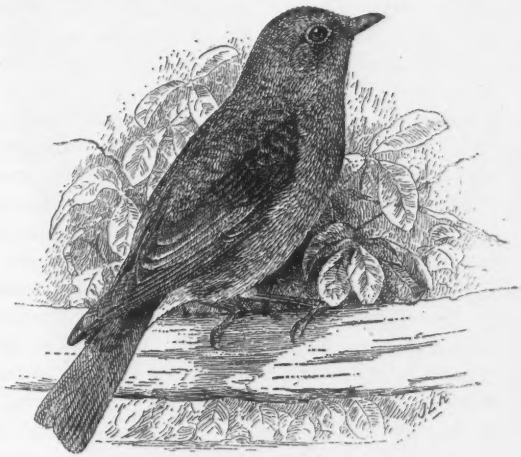

FIG. 22.—Bluebird.

is very noticeable in the months of August and September, when these insects form more than 60 per cent of the diet.

It is evident that in the selection of its food the bluebird is governed more by abundance than by choice. Predaceous beetles are eaten in spring, as they are among the first insects to appear; but in early summer caterpillars form an important part of the diet, and are replaced a little later by grasshoppers. Beetles are eaten at all times, except when grasshoppers are more easily obtained.

So far as its vegetable food is concerned, the bluebird is positively harmless. The only trace of any useful product in the stomachs consisted of a few blackberry seeds, and even these more probably belonged to wild than cultivated varieties. Following is a list of the various seeds which were found: Blackberry, chokeberry, juniperberry, pokeberry, partridgeberry, greenbrier, Virginia creeper, bit-

tersweet, holly, strawberry bush, false spikenard, wild sarsaparilla, sumac (several species), rose haws, sorrel, ragweed, grass, and asparagus. This list shows how little the bluebird depends upon the farm or garden to supply its needs, and indicates that by encouraging the growth of some of these plants, many of which are highly ornamental, the bird may be induced to make his home on the premises.

THE WESTERN BLUEBIRDS.

Two species of bluebirds inhabit the Western States—the mountain bluebird (*Sialia arctica*) and the Western bluebird (*S. mexicana*—subspecies). In their food habits they are even more to be commended than their eastern relative. Their insect food is obtainable at all times of the year, and the general diet varies only in the fall, when some fruit, principally elderberries, is eaten, though an occasional blackberry or grape is also taken. In an examination of 92 stomachs of *Sialia m. occidentalis* animal matter (insects and spiders) was found to the extent of 76 per cent and vegetable matter to the extent of 24 per cent. The bulk of the former consists of bugs, grasshoppers, and caterpillars. The grasshoppers are eaten freely during the whole season, when they can be obtained. Caterpillars also are a favorite food, and are eaten during every month of the year. Two stomachs, taken in January, contained 64 and 50 per cent, respectively, of caterpillars. Beetles also are eaten and comprise mostly harmful species.

The vegetable matter consists of a few weed seeds and small fruits. In December a few grapes are found, but elderberries are the favorites, whenever they can be obtained. It is only when these are in their greatest abundance that the vegetable food exceeds the animal food.

In the systematic arrangement of the birds of America, the bluebird has been placed at the head of the list, i. e., highest in point of development. In its food habits, considered in their economic relations, and in its general behavior toward the human race, the bird occupies a similar position.

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